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DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

RESULTS

OF

PRIMARY TRIANGULATION AND PRIMARY TRAVERSE

FISCAL YEAR 1901-02

BY

H. M. WILSON, J. H. RENSHAWE, E. M. DOUGLAS, AND R. U. GOODE



WASHINGTON
GOVERNMENT PRINTING OFFICE
1902

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C O N T E N T S.

	<i>Page.</i>
Letter of transmittal	9
Summary	11
Atlantic section of topography	12
New York	12
Triangulation stations	12
Desaw, Franklin County	12
Iron, Franklin County	12
Kildare, Franklin County	13
Pinnacle, Fulton County	13
Sacandaga, Fulton County	13
Stratford, Fulton County	14
Blue Ridge, Hamilton County	14
Buck, Hamilton County	14
Cathead, Hamilton County	15
Fish, Hamilton County	15
Hamilton, Hamilton County	16
Speculator, Hamilton County	16
Tomany, Hamilton County	16
Twin Lake, No. 1, Hamilton County	17
Twin Lake, No. 2, Hamilton County	17
West Creek, No. 1, Hamilton County	18
West Creek, No. 2, Hamilton County	18
Oak Hill, Herkimer County	19
Arab, St. Lawrence County	19
Beech Plains Church, St. Lawrence County	19
Canton Water Tower, St. Lawrence County	19
Fike, St. Lawrence County	20
Little Blue, St. Lawrence County	20
McCarthy, St. Lawrence County	21
Moosehead, St. Lawrence County	21
Nierny, St. Lawrence County	21
Norwood, St. Lawrence County	22
Panther, St. Lawrence County	22
Potsdam Presbyterian Church, St. Lawrence County	23
Rogers, St. Lawrence County	23
Stark, St. Lawrence County	24
Wheeler, St. Lawrence County	24
White Hill, St. Lawrence County	24
Roads, Sullivan County	25
Mill Creek, Warren County	25

	Page.
Atlantic section of topography—Continued.	
New York—Continued.	
Meridian marks	26
Johnstown, Fulton County	26
Pennsylvania	26
Triangulation stations	26
Chicory, Cambria County	26
Ebensburg, Cambria County	27
Fye, Cambria County	27
Sherbine, Cambria County	28
Swope, Cambria County	28
Thomas, Cambria County	28
Wess, Cambria County	29
Beck, Clearfield County	29
Davis, Clearfield County	30
Girard, Clearfield County	30
Kephart, Clearfield County	31
Kephart Tree, Clearfield County	31
Kyler, Clearfield County	32
McDowell, Clearfield County	32
Morrisdale, Clearfield County	33
Neeper, Clearfield County	33
Pardee, Clearfield County	33
Patterson, Clearfield County	34
Spangle, Clearfield County	34
Walls, Clearfield County	35
Bowser, Jefferson County	35
Maryland	36
Primary traverse	36
North Carolina	38
Primary traverse	38
Ohio	42
Primary traverse	42
Central section of topography	46
Ohio	46
Primary traverse	46
Alabama	68
Primary traverse	68
Indiana-Illinois	70
Primary traverse	70
Michigan	73
Primary traverse	73
Wisconsin	75
Primary traverse	75
Missouri	76
Primary traverse	76
Iowa	78
Primary traverse	78
Arkansas	80
Primary traverse	80
Nebraska	80
Primary traverse	80

CONTENTS.

5

	Page.
Rocky Mountain section of topography	83
Wyoming—Colorado	83
Triangulation stations	83
Wyoming	83
Azimuth Mark, Carbon County	83
Battle, Carbon County	84
Bridger, Carbon County	84
East Base, Carbon County	84
Fort Steele, Astronomic Station, Carbon County	85
Grennvile, Carbon County	85
Honnold, Carbon County	86
Medicine Bow, near Albany—Carbon County line	86
Mount Steele, Carbon County	86
Needle, Carbon County	87
Pelham, Carbon County	87
Platte, Carbon County	88
Rawlins, Carbon County	88
Riverside, Carbon County	88
Sage, Carbon County	89
St. Mary, Carbon County	89
Saratoga, Carbon County	90
Sharp, Carbon County	90
Three Point, Carbon County	90
West Base, Carbon County	90
Colorado	91
Anita, Routt County	91
Azimuth Station, Routt County	91
Hahn, Routt County	92
High Sharp, Routt County	92
Whitehead, Routt County	92
Zirkel, Routt County	93
Milepost 145, Colorado—Wyoming State line	93
Milepost 163, Colorado—Wyoming State line	93
Wyoming	93
Triangulation stations	93
Azimuth Station, Johnson County	93
Buffalo, Johnson County	94
Cone, Johnson County	94
Cross H, Johnson County	95
De Smet, Johnson County	95
McKinney, Johnson County	95
Shell, Johnson County	96
Banner, Sheridan County	96
George, Sheridan County	96
McCormick, Sheridan County	97
Prairie Dog, Sheridan County	97
Meridian marks	97
Buffalo, Johnson County	97

Rocky Mountain section of topography—Continued.	Page.
Montana	98
Triangulation stations	98
Monture, Deerlodge County	99
Nevada, Deerlodge County	100
Silvertip, Deerlodge County	100
Stonewall, Deerlodge County	101
Æneas, Flathead County	102
Baptiste, Flathead County	102
Coalbank, Flathead County	103
Gildart, Flathead County	103
G. N., Flathead County	103
Heavens, Flathead County	104
Moss, Flathead County	104
Stimpson, Flathead County	105
Swan, Flathead County	105
Vulture, Flathead County	106
Quigg, Granite County	106
Carey, Lewis and Clarke County	107
Cliff, on line between Lewis and Clarke and Deer Lodge counties	107
Dearborn, Lewis and Clarke County	108
East Base, Lewis and Clarke County	108
West Base, Lewis and Clarke County	109
Fairview, Lewis and Clarke County	109
Gamer, Lewis and Clarke County	110
Hilger, Lewis and Clarke County	110
Lenox, Lewis and Clarke County	111
Mitchell, Lewis and Clarke County	111
Mount Helena, Lewis and Clarke County	112
Pentagon, on line between Lewis and Clarke and Deer Lodge counties	112
Scapegoat, on line between Lewis and Clarke and Deer Lodge counties	113
Scratchgravel, Lewis and Clarke County	113
Whiteridge, Lewis and Clarke County	114
Gordon, on line between Missoula and Powell counties	114
Holland, Missoula County	114
Kamas, Missoula County	115
McDonald, Missoula County	115
McLeod, Missoula County	116
Miller (Miller Creek Peak), Missoula County	116
Daly, Ravalli County	117
El Capitan, Ravalli County	117
North Base, Ravalli County	118
St. Mary, Ravalli County	118
South Base, Ravalli County	119
Ward (1), Ravalli County	119
Ward (2), Ravalli County	120
Willow, Ravalli County	120
Alias, Teton County	121

	Page.
Rocky Mountain section of topography—Continued.	
Montana—Continued.	
Triangulation stations—Continued.	
Baker, Teton County	121
Boundary 373, Teton County	122
Chief Mountain, Teton County	122
Cleveland, Teton County	123
Connie, Teton County	123
Cutbank, Teton County	123
Divide, Teton County	124
Durham, Teton County	125
Elk, Teton County	125
Flattop, Teton County	125
Galbreath, Teton County	126
Half Dome, Teton County	126
Landslide, Teton County	127
Lincoln, Teton County	127
Milk River, Teton County	127
Observation, Teton County	128
Robertson, Teton County	128
Rocky, Teton County	128
Siyeh, Teton County	129
Arizona—New Mexico	130
Triangulation stations	130
Arizona	130
Geographic locations at Globe, Gila County	130
Mine locations	130
Center station	130
Northeast station	130
Nataxes, Gila County	130
Ash Peak, Graham County	131
Azimuth (2), Graham County	131
Bryce, Graham County	131
Gila, Graham County	132
Graham, Graham County	132
Guthrie, Graham County	133
Morenci, Graham County	133
Pima Church, Graham County	133
Shannon, Graham County	134
Sunset, Graham County	134
Triplets, Graham County	134
Turnbull, Graham County	135
New Mexico	135
Bullard, Grant County	135
Canyon, Grant County	136
Cliff, Grant County	136
Line, Grant County	136
Secho, Grant County	137
Mogollon, Socorro County	137
Pleasant, Socorro County	138

	Page.
Pacific section of topography	138
California	138
Triangulation stations	138
Central California	138
Brown, Alameda County	138
Brushy, Alameda County	139
Leal, Alameda County	139
Livermore, Alameda County	140
Lone Pine, Alameda County	140
Sunol, Alameda County	141
Trenouth, Alameda County	141
Bridge, Contra Costa County	142
Byron, Contra Costa County	142
Diablo, Contra Costa County	142
Wiedeman, Contra Costa County	143
Mocho, Santa Clara County	143
Randsburg mining district	144
Government, Kern County	144
Laurel, Kern County	145
Dome, San Bernardino County	145
El Paso, San Bernardino County	145
Johannesburg, San Bernardino County	145
Red, San Bernardino County	146
Sierra Forest Reserve	146
Breckenridge, Kern County	146
Cache, Kern County	147
Double, Kern County	147
Old Town, Kern County	147
Owens, Kern County	148
Pah Ute, Kern County	148
Pajuela, Kern County	149
Soledad, Kern County	149
Sunday, Kern County	149
Odell, Los Angeles County	150
Olancha, Inyo and Tulare counties	150
Whitney, Inyo and Tulare counties	150
Big Meadows, Tulare County	151
Florence, Tulare County	151
Moses, Tulare County	152
Primary traverse	152
Index	157

ILLUSTRATION.

PLATE I. Map showing condition of astronomic location and primary control	11
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LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., June 18, 1902.

SIR: We have the honor to transmit herewith, in form for publication, the results of the primary triangulation and primary traverse executed by the United States Geological Survey during the fiscal year 1901-2.

The results were computed by Messrs. A. H. Thompson, George T. Hawkins, C. F. Urquhart, R. H. Chapman, Frank Tweedy, Charles E. Cooke, W. H. Griffin, Sledge Tatum, and E. L. McNair, under the direction of Mr. S. S. Gannett, who likewise compiled them for publication.

Very respectfully,

H. M. WILSON,

Geographer in charge of Atlantic section.

J. H. RENSHAWE,

Geographer in charge of Central section.

E. M. DOUGLAS,

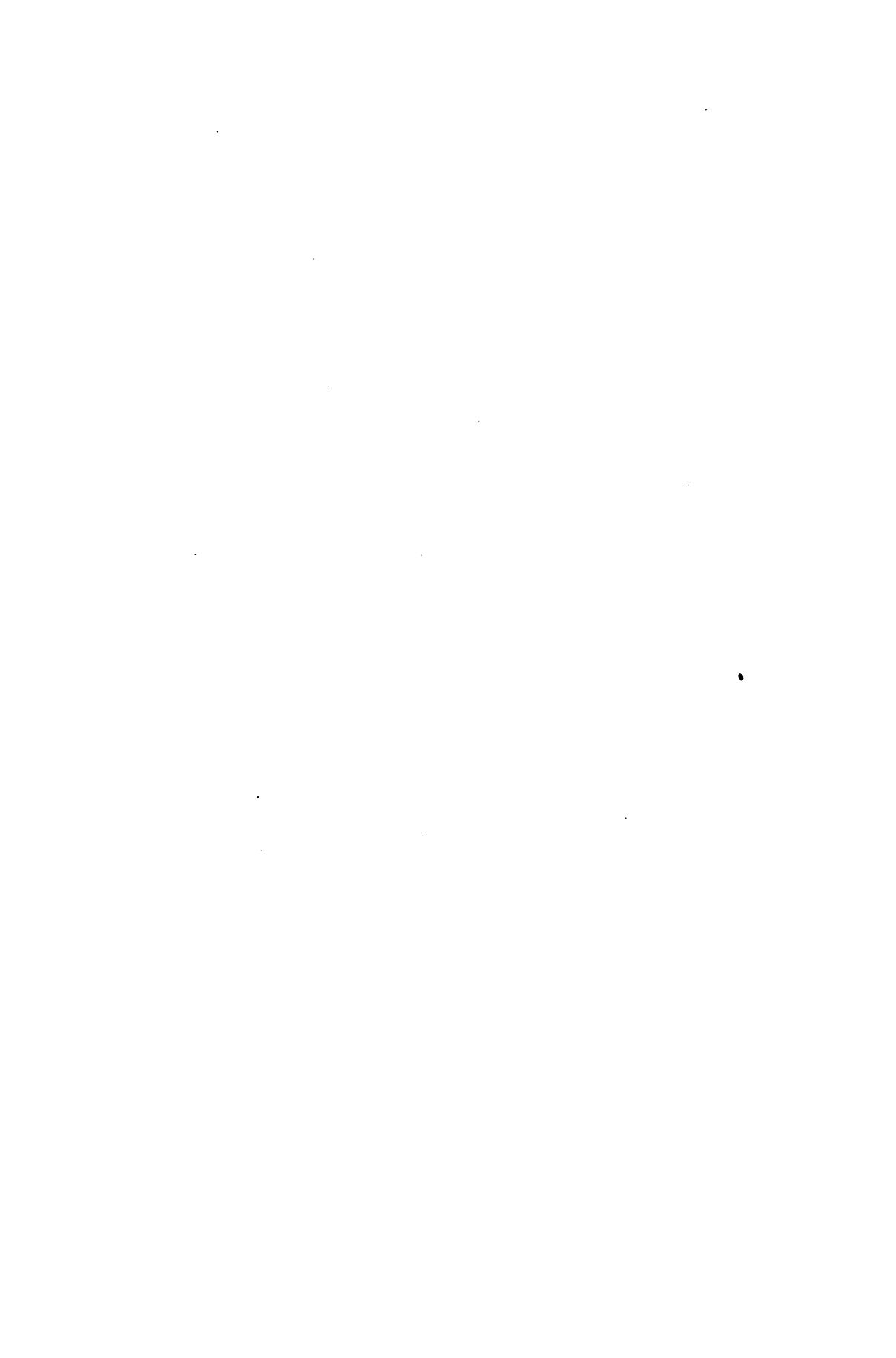
Geographer in charge of Rocky Mountain section.

R. U. GOODE,

Geographer in charge of Pacific section.

Hon. CHARLES D. WALCOTT,

Director United States Geological Survey.



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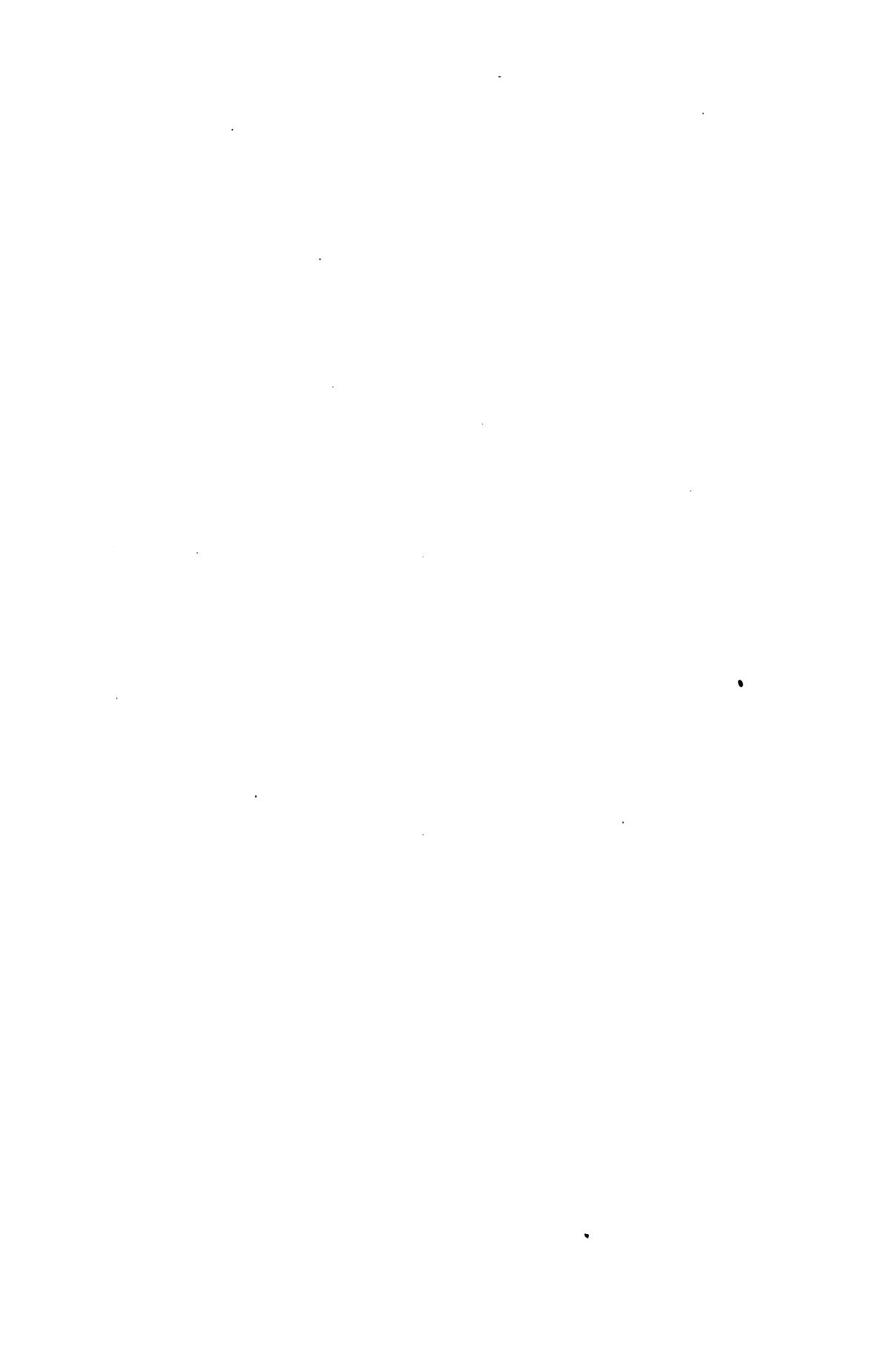
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ATLANTIC SECTION OF TOPOGRAPHY.

NEW YORK.

TRIANGULATION STATIONS.

Mr. E. L. McNair, topographer, was engaged during the first half of the field season in extending triangulation over the southern portion of the Adirondacks and during the remainder of the season over the northwestern part of the same region. He established and marked the positions of 35 stations, which control 9 15-minute quadrangles, covering portions of Fulton, Hamilton, St. Lawrence, Franklin, Saratoga, and Warren counties. He also established a meridian line at Johnstown.

DESAW, FRANKLIN COUNTY.

Situated about 2 miles east of Dickinson Center, on a large rock in field owned by Fred Desaw.

Station mark: A bronze triangulation tablet cemented in solid rock.

[Latitude $44^{\circ} 43' 12.69''$. Longitude $74^{\circ} 30' 58.14''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Nierny.....	55 51 07.54	285 40 10.66	4.3963093
White Hill.....	56 57 42.16	286 46 41.90	4.3929324
Norwood.....	97 43 38.65	277 24 10.29	4.5644263
Azure.....	356 54 38.76	176 55 12.93	4.2993577

IRON, FRANKLIN COUNTY.

A secondary station situated on the eastern side and 150 feet below summit of a high timbered mountain in Altamont Township, about 3 miles, air line, south of Derrick station on New York and Ottawa Railroad.

Station mark: A bronze triangulation tablet cemented in solid rock.

Reference mark: The spruce signal tree; true azimuth to same, $283^{\circ} 50'$; distance, 7.15 feet.

[Latitude $44^{\circ} 19' 14.2''$. Longitude $74^{\circ} 28' 56.3''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
St. Regis.....	231 03 17	51 09 40	4.19284
Morris.....	358 17 47	178 18 04	4.25234

KILDARE, FRANKLIN COUNTY.

A secondary station, situated at the western end of a high timbered mountain in Altamont Township, about 3 miles south of Derrick station, on the New York and Ottawa Railroad.

Station mark: A bronze triangulation tablet cemented in solid rock.

Reference mark: Spruce signal tree; true azimuth, $160^{\circ} 35'$; distance, 22 feet.

[Latitude $44^{\circ} 19' 09.9''$. Longitude $74^{\circ} 29' 26.1''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Little Blue.....	98 36 44	278 22 57	4.42298
Panther.....	119 15 47	299 04 36	4.38590
Azure.....	178 01 48	358 01 22	4.39190

PINNACLE, FULTON COUNTY.

Situated on a round timbered knob, partly cleared, in northen part of town of Bleecker.

Station mark: A bronze triangulation tablet cemented in solid rock.

[Latitude $43^{\circ} 18' 04.16''$. Longitude $74^{\circ} 28' 20.69''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Blue Ridge.....	169 12 05.03	349 11 27.46	3.8195692
Cathead.....	228 00 57.24	48 05 03.62	4.0376901
Sacandaga.....	266 31 33.43	86 38 18.76	4.1265109

SACANDAGA, FULTON COUNTY.

Situated on a partially cleared mountain about 2 miles west of Northville.

Station mark: A bronze triangulation tablet cemented in solid rock.

[Latitude $43^{\circ} 18' 30.01''$. Longitude $74^{\circ} 18' 28.84''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Pinnacle.....	86 38 18.76	266 31 33.43	4.1265109
Blue Ridge.....	111 21 18.89	291 13 50.76	4.1947207
Cathead.....	141 07 12.81	321 04 33.64	3.9213483
Buck.....	208 18 19.47	28 21 41.08	4.1452430

14 PRIMARY TRIANGULATION AND PRIMARY TRAVERSE. [BULL. 201.

STRATFORD, FULTON COUNTY.

A secondary station, situated on a low, bare knoll about one-fourth mile northeast of town of Stratford.

Station mark: A lone poplar tree 9 inches in diameter and 12 feet high.

Reference mark: A boulder 3 by 3 by 3 feet, distant $55\frac{1}{2}$ feet from station mark; true azimuth from mark $127^{\circ} 50'$.

[Latitude $48^{\circ} 11' 06.2''$. Longitude $74^{\circ} 41' 29.9''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	
Barto	69 30 56	249 22 48	4.23658
Oak Hill	127 50 22	307 48 57	3.54610
West Creek No. 2	180 40 23	0 40 28	4.09602
Tomany	221 15 05	41 19 56	4.16090

BLUE RIDGE, HAMILTON COUNTY.

Situated on a partly cleared, timbered ridge in town of Benson, about 5 miles west of Benson Center.

Station mark: A bronze triangulation tablet cemented in solid rock.

[Latitude $48^{\circ} 16' 34.25''$. Longitude $74^{\circ} 24' 15.54''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	
Tomany	93 12 48.07	273 05 49.33	4.1396657
West Creek No. 1	96 18 18.13	276 01 29.29	4.3699741
Twin Lake No. 2	142 30 55.00	322 23 31.00	4.37794
Twin Lake No. 1	144 02 51.76	323 55 50.84	4.3706853
Hamilton	191 26 40.71	11 28 13.64	4.1861832
Buck	252 35 27.24	72 46 12.52	4.3465601
Cathead	265 01 18.09	85 06 02.20	3.9721603
Sacandaga	291 13 50.76	111 21 13.89	4.1947207
Pinnacle	349 11 27.46	169 12 05.03	3.8195692

BUCK, HAMILTON COUNTY.

Situated on a cleared mountain about 4 miles northeast of Hope Falls, Hamilton County, and near the Saratoga-Hamilton County line.

Station mark: A bronze triangulation tablet cemented in solid rock.

[Latitude 43° 20' 08.51". Longitude 74° 08' 34.75".]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Sacandaga	28 21 41.08	208 18 19.47	4.1452430
Cathead	63 58 35.96	243 52 34.91	4.1207917
Blue Ridge	72 46 12.52	252 35 27.24	4.3465601
Hamilton	115 01 25.72	294 52 12.62	4.3009785
Mill Creek	200 27 17.27	20 31 15.56	4.3478133
Bald Head	221 34 28.11	41 41 42.84	4.3309793
Wells	251 41 36.93	71 48 41.35	4.1661806

CATHEAD, HAMILTON COUNTY.

Situated in town of Benson, about 1 mile north of Benson post-office, on a burnt rocky hill.

Station mark: A bronze triangulation tablet cemented in solid rock.

Reference mark: A dead tree used as signal; distant 33.3 feet, true azimuth, 89° 09' from mark.

[Latitude 43° 17' 04.42". Longitude 74° 17' 21.12".]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Pinnacle	48 05 03.62	228 00 57.24	4.0376901
Blue Ridge	85 06 02.20	265 01 18.09	3.9721603
Hamilton	156 12 45.49	336 09 33.96	4.1921313
Speculator	168 06 57	348 04 51	4.30218
Buck	243 52 34.91	63 58 35.96	4.1207917
Sacandaga	321 04 33.64	141 07 12.81	3.9213483

FISH, HAMILTON COUNTY.

(Not occupied.)

A secondary point situated on a bare hill, about 2 miles west of Lake Pleasant. Probably a station of the Colvin Survey.

[Latitude 43° 28' 18.1". Longitude 74° 27' 36.3".]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Tomany	23 48 26	203 43 45	4.35993
West Creek No. 1	44 22 14	224 12 42	4.42900
Twin Lake No. 1	73 38 08	253 33 23	3.98512
Hamilton	311 24 58	131 28 50	4.00363

HAMILTON, HAMILTON COUNTY.

A United States Coast and Geodetic Survey triangulation station, situated on a high cleared mountain about 3 miles south of Lake Pleasant.

Station mark: A copper bolt set in solid rock and marked "U. S. G. S. 465 N. Y.", near which is a United States Coast and Geodetic Survey copper bolt, not marked.

[Latitude 43° 24' 41.82". Longitude 74° 22' 00.14".]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Blue Ridge.....	11 28 13.64	191 26 40.71	4.1861832
Tomany.....	49 42 09.98	229 38 37.78	4.3435825
West Canada.....	113 22 30.27	298 07 42.24	4.4994236
Little Moose.....	150 10 42.30	330 02 15.89	4.5200577
Snowy.....	177 03 15.52	357 02 24.76	4.5065186
Big Range.....	206 09 35.82	26 14 31.60	4.3397301
Gore.....	221 33 38.32	41 46 44.82	4.5860772
Mill Creek.....	244 14 46.95	64 27 59.47	4.4582536
Crane.....	245 28 19.04	65 44 59.34	4.5547813
Prospect.....	268 28 38.73	88 53 20.26	4.6858085
Wells.....	276 42 21.77	96 58 39.81	4.5087915
Buck.....	294 52 12.62	115 01 25.72	4.3009785
Cathead.....	336 09 33.96	156 12 45.49	4.1921313

SPECULATOR, HAMILTON COUNTY.

(Not occupied.)

A secondary point situated on a partly timbered mountain about 3 miles south of Speculator. Probably a station of the Colvin Survey.

[Latitude 43° 27' 36.2". Longitude 74° 20' 24.8".]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Hamilton.....	21 43 39	201 42 34	3.76294
Twin Lake No. 1.....	85 45 06	265 35 26	4.27932
Cathead.....	348 04 51	168 06 57	4.30218

TOMANY, HAMILTON COUNTY.

Situated in town of Arietta about 4 miles northwest of Arietta, on a timbered mountain about 1½ miles west of highway leading to Piseco

Lake. Summit of mountain has been cleared. Theodolite was supported on a beech tree sawed off 25 feet above ground, around which was built a tower and platform.

Station mark: A bronze triangulation tablet cemented in solid rock.

Reference mark: The beech signal tree 20 feet distant; true azimuth $156^{\circ} 26'$ from mark.

[Latitude $43^{\circ} 16' 58.85''$. Longitude $74^{\circ} 34' 26.34''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Stratford.....	41 19 55	221 15 05	4.16090
Oak Hill.....	54 46 05	234 39 50	4.17918
Barto.....	56 43 04	236 30 05	4.48817
West Creek No. 2.....	99 38 32.33	279 33 46.34	3.9793818
West Creek No. 1.....	100 23 16.70	280 18 26.65	3.9864913
Twin Lake No. 2.....	177 29 49	357 29 25	4.25977
Twin Lake No. 1.....	179 50 28.83	359 50 27.30	4.2608692
Fish.....	203 43 45	28 48 26	4.35993
Hamilton.....	229 33 37.78	49 42 09.98	4.3435825
Blue Ridge.....	273 05 49.33	93 12 48.07	4.1396657

TWIN LAKE NO. 1, HAMILTON COUNTY.

Situated in Arietta Township about 4 miles west of Piseco Lake on the east edge of a timbered mountain.

Station mark: A bronze triangulation tablet cemented in solid rock.

[Latitude $43^{\circ} 26' 49.68''$. Longitude $74^{\circ} 34' 28.58''$.]

To station—	Azimuth.	Back azimuth.	Log. distance,
	° ' "	° ' "	<i>Meters.</i>
West Creek No. 2.....	29 20 23.69	209 15 38.81	4.2806716
West Creek No. 1.....	29 54 43.63	209 49 54.68	4.2791890
Fish.....	253 33 23	78 38 08	3.98512
Speculator.....	265 35 26	85 45 06	4.27982
Hamilton.....	283 07 12.71	108 15 47.23	4.2378111
Blue Ridge.....	323 55 50.84	144 02 51.76	4.3706853
Tomany.....	359 50 27.30	179 56 28.88	4.2608692

TWIN LAKE NO. 2, HAMILTON COUNTY.

A secondary point situated in Arietta Township, about 4 miles west of Piseco Lake, on west end of a timbered mountain.

Station mark: A bronze triangulation tablet cemented in solid rock.

18 PRIMARY TRIANGULATION AND PRIMARY TRAVERSE. [BULL. 201.

[Latitude $43^{\circ} 26' 47.6''$. Longitude $74^{\circ} 35' 01.7''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Blue Ridge.....	° ' "	° ' "	<i>Meters.</i>
Tomany.....	322 23 31	142 30 55	4. 87794
Tomany.....	357 29 25	177 29 49	4. 25977

WEST CREEK NO. 1, HAMILTON COUNTY.

Situated on the northwest end of a narrow ridge about one-fourth mile long in the southern part of Hamilton County, about 3 miles west of the Powley place, on road from Stratford to Piseco Lake.

Station mark: A copper bolt set in solid rock and marked "U. S. G. S. N. Y. 486."

Reference mark: The spruce signal tree 27 feet distant from station mark; true azimuth, $328^{\circ} 40'$.

[Latitude $43^{\circ} 17' 55.27''$. Longitude $74^{\circ} 41' 29.84''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Schuyler.....	° ' "	° ' "	<i>Meters.</i>
Cold Brook.....	66 25 45.00	246 08 31.00	4. 57643
Pen.....	80 00 51.00	259 48 45.00	4. 41872
Twin Lake No. 1.....	101 13 36.00	280 50 11.00	4. 67191
Fish.....	209 49 54.68	29 54 43.63	4. 2791890
Hamilton.....	224 12 42.00	44 22 14.00	4. 42900
Hamilton.....	244 24 39.65	64 38 02.33	4. 4648879
Blue Ridge.....	276 01 29.29	96 13 18.13	4. 3699741
Tomany.....	280 18 26.65	100 23 16.70	3. 9864913

WEST CREEK NO. 2, HAMILTON COUNTY.

Situated on the southeast end of a narrow ridge about one-fourth mile long in the southern part of the county, about 3 miles west of the Powley place, on road from Stratford to Piseco Lake.

Station mark: A bronze triangulation tablet set in solid rock.

Reference mark: The spruce signal tree 13.65 feet distant from station mark; true azimuth, $350^{\circ} 46'$.

[Latitude $43^{\circ} 17' 50.40''$. Longitude $74^{\circ} 41' 23.42''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Stratford.....	° ' "	° ' "	<i>Meters.</i>
Twin Lake No 1.....	0 40 28.00	180 40 23.00	4. 09602
Hamilton.....	209 15 38.81	29 20 23.69	4. 2806716
Hamilton.....	244 01 54.16	64 15 12.76	4. 4640717
Tomany.....	279 33 46.34	99 38 32.33	3. 9793818

OAK HILL, HERKIMER COUNTY.

A secondary station situated on the eastern side of a timbered mountain, about 2 miles northwest of Stratford.

Station mark: An ash tree 14 inches in diameter.

[Latitude $43^{\circ} 12' 16.1''$. Longitude $74^{\circ} 43' 32.9''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Tomany.....	234 39 50	54 46 05	4.17918
Stratford.....	307 48 57	127 50 22	3.54610

ARAB, ST. LAWRENCE COUNTY.

A secondary station situated on a partly cleared mountain about $1\frac{1}{2}$ miles east of Childwold station, on New York Central Railroad.

Station mark: A bronze triangulation tablet cemented in solid rock.

[Latitude $44^{\circ} 12' 16.8''$. Longitude $74^{\circ} 35' 20.5''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Wheeler.....	73 01 01	252 58 32	3.69594
Moosehead.....	144 02 04	323 58 00	4.11987
Morris.....	298 46 37	118 51 21	4.01481

BEECH PLAINS CHURCH, ST. LAWRENCE COUNTY

(Not occupied.)

Secondary point situated in town of Pierrepont.

Station mark: Tower of church.

[Latitude $44^{\circ} 30' 45.4''$. Longitude $75^{\circ} 04' 28.0''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
McCarthy.....	254 56 52	75 05 19	4.21820
Stark.....	307 22 34	127 27 07	4.03564

CANTON WATER TOWER, ST. LAWRENCE COUNTY.

(Secondary point. Not occupied.)

Station mark: Center of water tower.

[Latitude $44^{\circ} 35' 41.4''$. Longitude $75^{\circ} 09' 47.8''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
White Hill	° ' "	° ' "	<i>Meters.</i>
	269 04 32	89 20 51	4.48811
McCarthy	281 47 02	101 59 17	4.37320
Fike	295 20 25	115 34 54	4.48160
Stark	314 51 05	134 59 26	4.34790

FIKE, ST. LAWRENCE COUNTY.

Situated on a high, bare knob in southwest corner of town of Parishville, on land owned by Benjamin Fike, who lives about 50 rods north of station.

Station mark: A bronze triangulation tablet cemented in solid rock.

[Latitude $44^{\circ} 28' 39.21''$. Longitude $74^{\circ} 49' 07.84''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Little Blue	° ' "	° ' "	<i>Meters.</i>
	0 03 09.92	180 03 09.52	4.1354408
Stark	76 56 55.90	256 50 48.11	4.0761604
McCarthy	153 33 38.08	332 31 18.37	3.9639417
White Hill	194 17 03.42	14 18 52.38	4.1425627
Nierny	195 15 38.27	15 17 30.62	4.1278494
Azure	254 15 12.54	74 28 34.05	4.4187160
Panther	319 15 13.24	139 17 49.21	3.8778808
Moosehead	331 39 39.01	151 45 13.51	4.3488909

LITTLE BLUE, ST. LAWRENCE COUNTY.

Situated on a rocky knob (nearly cleared) in southeast corner of town of Granshur, at the headwaters of the middle fork of the Grasse River. Best reached from the camp of the "Hollywood Club," on Clear Pond, 2 miles distant.

Station mark: A bronze triangulation tablet cemented in solid rock.

[Latitude $44^{\circ} 21' 16.67''$. Longitude $74^{\circ} 49' 08.41''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Stark	° ' "	° ' "	<i>Meters.</i>
	133 24 22.24	313 18 15.25	4.2030889
McCarthy	169 02 09.28	348 59 55.15	4.3470034
Fike	180 03 09.52	360 03 09.92	4.1354408
Panther	211 53 07.12	31 55 43.38	3.9708924
Azure	230 33 17.90	50 46 38.98	4.5145711
Moosehead	299 27 32.55	119 33 07.08	4.0859436
Morris	308 10 34.15	128 24 56.78	4.5432946

M'CARTHY, ST. LAWRENCE COUNTY.

Situated on a partly cleared hill about 3 miles east of Colton, in town of Colton, on land owned by Mr. McCarthy, who lives about one-half mile west of station.

Station mark: A bronze triangulation tablet cemented in solid rock.

[Latitude $44^{\circ} 33' 08.78''$. Longitude $74^{\circ} 52' 19.98''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Stark	34 07 11.76	214 03 18.41	4.1180159
Norwood	161 11 43.05	341 07 25.98	4.3972766
Nierny	238 22 01.19	58 26 08.45	3.9603360
Azure	272 00 13.36	92 15 50.18	4.4698326
Fike	332 31 18.37	152 33 33.08	3.9639417
Little Blue	348 59 55.15	169 02 09.28	4.2030889

MOOSEHEAD, ST. LAWRENCE COUNTY.

Situated on a cleared mountain in Jamestown township, on south side of Raquette River, about $1\frac{1}{2}$ miles northeast of Sevey post-office.

A signal of New York State land survey is on same mountain, about 500 feet distant.

Station mark: A bronze triangulation tablet cemented in solid rock.

[Latitude $44^{\circ} 18' 02.19''$. Longitude $74^{\circ} 41' 09.67''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Little Blue	119 33 07.08	299 27 32.55	4.0859436
Fike	151 45 18.51	331 39 39.01	4.3488909
Panther	157 56 32.83	337 53 34.22	4.1773993
Azure	208 46 02.30	28 53 47.86	4.4844836
St. Regis	246 56 14.88	67 11 10.66	4.4887547
Morris	312 52 57.88	133 01 46.12	4.3610592

NIERNY, ST. LAWRENCE COUNTY.

Situated on a bare knoll about 3 miles southeast of Parishville, on land owned by Mr. Nierny, who lives about 200 yards south of station.

Station mark: A bronze triangulation tablet cemented in solid rock.

[Latitude $44^{\circ} 35' 38.71''$. Longitude $74^{\circ} 46' 27.66''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Fiike	15 17 30.62	195 15 38.27	4.1278494
Stark	44 06 11.35	223 58 10.86	4.3878501
McCarthy	58 26 08.45	238 22 01.19	3.9603360
Norwood	140 03 24.73	319 54 59.79	4.3909598
Desaw	235 40 10.66	55 51 07.54	4.3963093
Azure	285 04 14.54	105 15 44.47	4.3517520

NORWOOD, ST. LAWRENCE COUNTY.

Situated on a low, sandy knoll about 1 mile north of Norwood.

Station mark: A flat stone about 30 inches square and 8 inches thick, in the top of which is cemented a bronze triangulation tablet.

[Latitude $44^{\circ} 45' 49.12''$. Longitude $74^{\circ} 58' 25.85''$.]

To station—	Azimuth.	Back azimuth.	Log. distince.
Desaw	277 24 10.29	97 43 33.65	4.5644263
Azure	303 14 18.51	123 34 12.20	4.6523077
White Hill	319 20 20.50	139 28 42.10	4.3828385
Nierny	319 54 59.79	140 03 24.73	4.3909598
McCarthy	341 07 25.93	161 11 48.05	4.3972766
Stark	358 47 24.30	178 47 47.41	4.5378178

PANTHER, ST. LAWRENCE COUNTY.

Situated on a cleared mountain, locally known as Catamount Mountain, on the west side of the Raquette River, about 3 miles southeast of Stark post-office, and about twenty minutes walk from the main highway.

Station mark: A bronze triangulation tablet cemented in solid rock.

Reference mark: New York State land survey signal and station mark distant 3.05 feet; true azimuth, $308^{\circ} 04'$ from station.

[Latitude 44° 25' 33.86". Longitude 74° 45' 25.09".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Little Blue	31 55 43.33	211 53 07.12	3.9708924
Stark	100 25 11.81	280 16 28.25	4.2255977
Fike	139 17 49.21	319 15 13.24	3.8778808
Azure	237 45 17.54	57 46 02.60	4.3807413
St. Regis	273 06 10.88	98 24 06.43	4.5321590
Morris	322 42 42.45	142 54 29.66	4.5698926
Moosehead	337 53 34.22	157 56 32.83	4,1773993

POTSDAM PRESBYTERIAN CHURCH, ST. LAWRENCE COUNTY.

(Not occupied.)

Secondary point situated in town of Potsdam.

Station mark: Center of church tower.

[Latitude 44° 40' 12.5". Longitude 74° 58' 52.9".]

To station—	Azimuth.	Back azimuth.	Log. distance.
White Hill	295 53 22	116 02 02	4.25889
McCarthy	326 45 07	146 49 43	4.19915
Stark	356 51 02	176 51 44	4.38271
Nierny	297 09 19	117 18 03	4.26655

ROGERS, ST. LAWRENCE COUNTY.

(Not occupied.)

Secondary point situated on a low, bare hill in town of Norfolk, about one-half mile southwest of Plum Brook station, on Rome, Watertown and Ogdensburg division of New York Central and Hudson River Railroad. The land is owned by W. H. Rogers, who lives about 50 rods northeast of station.

Station mark: The elm signal tree, about 15 inches in diameter.

[Latitude 44° 49' 41.6". Longitude 74° 55' 54.8".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Norwood	24 51 09	204 49 23	3.89793
Nierny	334 18 43	154 25 22	4.46025
McCarthy	351 14 53	171 17 24	4.49360

STARK, ST. LAWRENCE COUNTY.

Situated on a timbered ridge in northeast corner of the town of Clare, on the west side of the North Branch of the Grasse River, on land owned by Irving Stark.

Theodolite elevated 52 feet on a tower built around trunk of a beech tree.

Station mark: A bronze triangulation tablet cemented in solid rock.

Reference marks. Center of signal tower and tree 46.3 feet distant. True azimuth $238^{\circ} 12'$. Nail in top of stump of beech tree distant 75.4 feet. True azimuth $355^{\circ} 16'$ from station.

[Latitude $44^{\circ} 27' 11.69''$. Longitude $74^{\circ} 57' 52.90''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	
Norwood.....	178 47 47.41	358 47 24.30	4.5378178
McCarthy.....	214 03 18.41	34 07 11.76	4.1180159
White Hill.....	222 51 17.55	42 59 14.67	4.3436695
Nierny.....	223 58 10.86	44 06 11.35	4.3378501
Fike.....	256 50 48.11	76 56 55.90	4.0761604
Panther.....	280 16 28.25	100 25 11.81	4.2255977
Little Blue.....	313 18 15.25	133 24 22.24	4.2030889

WHEELER, ST. LAWRENCE COUNTY.

(Not occupied.)

Secondary point situated on a low mountain partly burned over, 3 miles, air line, southwest of Arab Mountain. Timber on north side of mountain.

Station mark: A bronze triangulation tablet cemented in solid rock.

[Latitude $44^{\circ} 11' 29.7''$. Longitude $74^{\circ} 38' 54.3''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	
Arab.....	252 58 32	73 01 01	3.69594
Morris.....	284 17 31	104 24 44	4.15417

WHITE HILL, ST. LAWRENCE COUNTY.

Situated on a bare knoll about 3 miles southeast of Parishville, on land owned by Welch Brothers, who live about 40 rods southeast of station.

Station mark: A bronze triangulation tablet cemented in solid rock.

[Latitude $44^{\circ} 35' 55.12''$. Longitude $74^{\circ} 46' 32.50''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Pike	14 18 52.38	194 17 03.42	4.1425627
Stark	42 59 14.67	222 51 17.55	4.3436695
Norwood	139 28 42.10	319 20 20.50	4.3828885
Desaw	236 46 41.90	56 57 42.16	4.3929324
Azure	286 14 01.09	106 25 34.44	4.3563551

ROADS, SULLIVAN COUNTY.

In Manakating Township, on a high brushy ridge 3 miles west of Westbrookville, a station on the Port Jervis, Monticello and New York Railroad.

Station mark: A bronze triangulation tablet set in boulder 30 by 18 by 18 inches, above which was built a mound of stone 3 feet high with 4 feet base.

Reference marks: Arrow cut in flat rock 4 by 3 feet and 1 foot above ground; azimuth, 91° ; distance, 32.86 feet. Arrow cut in boulder 4 by 3 feet and 2 feet above ground; azimuth, 347° ; distance, 25.57 feet.

[Latitude $41^{\circ} 32' 09.44''$. Longitude $74^{\circ} 37' 27.97''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
High Point	7 29 02.6	187 27 33.4	4.3817799
Wolf	205 53 43.1	25 55 18.2	3.8809053
Sams Point	235 59 37.5	56 10 16.9	4.4292886
Vernon	285 38 24.0	105 42 44.9	3.9765996
Writer	338 27 00.6	158 28 59.5	4.0548316

MILL CREEK, WARREN COUNTY.

On the west side of Mill Creek Pond, in lot 16, in town of Thurman, on a high burned-over mountain having numerous dead trees still standing. The land belongs to the State.

Station mark: A 1-inch hole drilled $2\frac{1}{2}$ inches deep in highest part of solid rock.

Reference mark: A dead spruce tree used as signal; distance, 18 feet 4 inches; true azimuth, $32^{\circ} 28'$ from mark.

[Latitude $43^{\circ} 31' 24.63''$. Longitude $74^{\circ} 02' 48.13''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Buck	20 31 15.55	200 27 17.27	4.3478133
Hamilton	64 27 59.47	244 14 46.95	4.4582536
Crane	250 35 57.01	70 39 24.86	3.8562727
Bald Head	307 00 56.45	127 04 13.88	3.9059145
Wells	339 24 18.46	159 27 25.25	4.2401419

MERIDIAN MARKS.

JOHNSTOWN, FULTON COUNTY.

Location of station: On line of outer race track-fence, east of main entrance to track. On the grounds of the Fulton County Agricultural Society.

Station mark: A marble post 36 by 6 by 6 inches, set 35 inches in the ground, in the center of top of which is cemented a bronze meridian tablet.

Distant mark: North of station 448 feet and 3 feet outside of outer race-track fence. A marble post 38 by 6 by 6 inches, set 36 inches in the ground, in the center of top of which is cemented a bronze meridian tablet.

Local referee: John F. Campbell, city engineer's office.

PENNSYLVANIA.

TRIANGULATION STATIONS.

Triangulation in the central portion of the State was extended from stations Wopsononock and Tunnel Hill, established in 1900, so as to control seven quadrangles in Cambria and Clearfield counties. Twenty-two stations were occupied and four secondary points were located by Mr. S. S. Gannett, geographer, during July, August, September, and October, 1901. Connection was made with the work of 1899, in Indiana County, at stations Palmer, McCoy, and Nolo, a circuit 370 miles in length thus being completed.

CHICORY, CAMBRIA COUNTY.

On a cleared knob in the central part of Jackson Township, 10 miles by road westward from Ebensburg, 300 yards south of the Chicory Hill schoolhouse.

Station mark: A marble post 34 by 6 by 6 inches, set 32 inches in the ground, in the center of top of which is countersunk and cemented a bronze triangulation tablet.

[Latitude $40^{\circ} 26' 38.97''$. Longitude $78^{\circ} 52' 48.20''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Ebensburg	251 24 48.82	71 30 51.47	4.1425539
Wess	292 00 35.81	112 04 41.22	3.9833693
Fye	318 31 18.78	138 37 47.50	4.3303852

EBENSBURG, CAMBRIA COUNTY.

Station is center of cupola of court-house in Ebensburg.

Station mark: Center of cupola.

[Latitude $40^{\circ} 29' 02.07''$. Longitude $78^{\circ} 43' 29.50''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Thomas	156 58 25.25	336 57 06.21	3.8644894
Carrolltown	185 49 38.40	5 50 15.62	4.1222362
Wopsononock	248 52 46.94	69 03 52.34	4.4120176
Tunnel Hill	270 56 22.25	91 03 22.64	4.1833798
Sherbine	0 52 21.75	180 52 15.82	4.1515885
Wess	27 55 04.38	207 53 07.38	3.9581867
Chicory	71 30 51.47	251 24 48.82	4.1425539

FYE, CAMBRIA COUNTY.

[Not occupied.]

A cleared ridge known as the "Fye Place," owned by the Mountain Coal Company, in Adams Township, 6 miles south of Summerhill and 7 miles southeast of South Fork.

Station mark: A marble post 36 by 6 by 6 inches, set 32 inches in the ground, in the center of top of which is countersunk and cemented a bronze triangulation tablet.

Reference mark: The lone locust signal tree 4 feet north of station mark.

[Latitude $40^{\circ} 17' 58.79''$. Longitude $78^{\circ} 42' 48.19''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Chicory	188 37 47.50	318 31 18.78	4.3303852
Wess	157 12 06.81	337 09 43.27	4.1299536
Sherbine	169 16 09.98	349 15 37.33	3.8058254

SHERBINE, CAMBRIA COUNTY.

On a small hill, having scattering locust trees on its summit, in Croyle Township, about $\frac{1}{4}$ mile west of the Summerhill township line, 2 miles southwest of Wilmore, 2 miles southeast of Summerhill post-office, on land of Aaron Sherbine. Theodolite elevated 28 feet.

Station mark: A marble post 36 by 6 by 6 inches, set 32 inches in the ground, in the center of top of which is countersunk and cemented a bronze triangulation tablet.

[Latitude $40^{\circ} 21' 22.50''$. Longitude $78^{\circ} 43' 38.65''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Wess	° ' "	° ' "	<i>Meters.</i>
Wess	146 43 20.03	326 41 29.11	3.8666773
Ebensburg	180 52 15.82	0 52 21.75	4.1515885
Tunnel Hill	228 00 07.85	48 07 13.50	4.8183278
Fye	349 15 37.33	169 16 09.98	3.8058254

SWOPE, CAMBRIA COUNTY.

On a flat ridge in the central portion of Chest Township, 3 miles by road northnortheast of Patton, in corner of lane 200 yards northwest of residence of Miss Lizzie Swope. Theodolite elevated 25 feet.

Station mark: A sandstone post 36 by 6 by 6 inches, set 30 inches in the ground, in the center of top of which is cemented a bronze triangulation tablet.

[Latitude $40^{\circ} 40' 47.99''$. Longitude $78^{\circ} 39' 04.20''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Thomas	° ' "	° ' "	<i>Meters.</i>
Thomas	31 12 16.66	211 08 04.77	4.2449177
McCoy	94 48 52.15	274 36 26.89	^a 4.4302943
Palmer	115 01 19.41	294 48 37.39	^a 4.4801794
Beck	154 43 22.37	334 39 53.74	4.2440372
Patterson	189 00 38.52	9 02 00.04	4.2712711
Spangle	235 14 55.19	55 20 18.75	4.1511289
Wopsononock	304 58 39.08	125 06 53.08	4.9381111

^aMean.

THOMAS, CAMBRIA COUNTY.

Situated about 5 miles northwest of Ebensburg on a bare ridge known as Thomas Ridge.

Station mark: A marble post 36 by 6 by 6 inches set 32 inches in the ground on fence line between property of John Thomas and

Augustus Bash. In center of top of post is cemented a bronze triangulation tablet.

Reference mark: A lone cherry tree on fence line where it crosses summit of ridge; azimuth from station mark, 111° ; distance, 4.5 feet.

[Latitude $40^{\circ} 32' 40.45''$. Longitude $78^{\circ} 45' 31.17''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Tunnel Hill	291 04 07.15	111 12 26.84	4.2881485
Ebensburg	336 57 06.21	156 58 25.25	3.8644894
Wess	5 21 15.32	185 20 37.23	4.1710473
Nolo			4.2420542
Beck	182 55 29.61	2 56 13.52	4.4904668
Swope	211 08 04.77	31 12 16.66	4.2449177
Wopsononock	264 32 02.92	84 44 27.84	4.4325554

WESS, CAMBRIA COUNTY.

In the northern portion of Croyle Township, 8 miles southwest of Ebensburg, 1 mile west of New Germany, in a pasture owned by Leo Wess. Theodolite elevated 35 feet.

Station mark: A marble post 36 by 6 by 6 inches, set 32 inches in the ground, in the center of the top of which is countersunk and cemented a bronze triangulation tablet.

Reference mark: Line fence due north 44 feet distant. Center of big dead tree, N. 65° W. (magnetic), 31 feet distant.

[Latitude $40^{\circ} 24' 41.86''$. Longitude $78^{\circ} 46' 29.85''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Chicory	112 04 41.22	292 00 35.81	3.9883693
Thomas	185 20 37.23	5 21 15.32	4.1710473
Ebensburg	207 53 07.38	27 55 04.38	3.9581867
Sherbine	326 41 29.11	146 43 20.03	3.8666773
Fye	337 09 43.27	157 12 06.81	4.1299536

BECK, CLEARFIELD COUNTY.

On a cultivated knob in Burnside Township, 2 miles west of New Washington, $5\frac{1}{2}$ miles south of Mahaffey, on land owned by Mr. Beck, who lives on southwest side of knob. View cut off by a fringe of timber on north side of hill; fine view in other directions.

Station mark: A sandstone post 32 by 6 by 6 inches, set 30 inches

in the ground, in the center of top of which is cemented a bronze triangulation tablet.

[Latitude $40^{\circ} 49' 22.06''$. Longitude $78^{\circ} 44' 23.81''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Thomas	2 56 18.52	182 55 29.61	4.4904668
Palmer	81 07 47.50	260 58 33.24	^a 4.3087143
Bowser	145 43 17.82	325 40 06.05	4.0855574
Walls	165 35 47.75	345 34 28.28	4.0578282
Patterson	256 00 42.07	76 05 32.70	4.0306219
Swope	334 39 53.74	154 43 22.37	4.2440373

^aMean.

DAVIS, CLEARFIELD COUNTY.

A round knob with a clump of timber on its summit in Penn Township, 2 miles southwest of Grampian station, on the southern side of and 15 feet lower than summit, giving a view in all directions excepting northward. E. M. Davis, owner, lives one-fourth mile south.

Station mark: A marble post 36 by 6 by 6 inches, set 30 inches in the ground, in the center of top of which is cemented a bronze triangulation tablet.

Reference mark: Oak signal tree; azimuth $17^{\circ} 09'$, distant from station mark 7 feet.

[Latitude $40^{\circ} 57' 38.51''$. Longitude $78^{\circ} 38' 05.40''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Walls	70 04 30.56	249 59 08.01	4.0948567
Nepper	241 28 13.00	61 31 41.88	3.9280619
Kyler	269 56 10.89	90 08 07.96	4.4078921
Kephart	289 29 06.67	109 40 29.30	4.4129932
Spangle	336 03 31.50	156 08 17.51	4.4027012
Patterson	353 04 01.09	173 04 44.35	4.1079136

GIRARD, CLEARFIELD COUNTY.

A high knob, locally known as "Big Knob," in Girard Township, 7 miles by road north of Shawsville, 12 miles northwest of Frenchville; on south side of knob, about 100 feet lower than summit, at upper edge of field, and has an unobstructed view east, south, and west. On land owned by Peter Brown, but near the property line of the widow Krise.

Station mark: A marble post 36 by 6 by 6 inches, set 34 inches in the ground, having a bronze triangulation tablet cemented in its top.

[Latitude $41^{\circ} 08' 49.76''$. Longitude $78^{\circ} 20' 05.57''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Neeper	46 54 57.36	226 46 37.18	4.3867337
Pardee	323 56 18.24	144 02 33.44	4.3556921
McDowell	349 17 10.17	169 18 13.96	4.0861395
Kyler	359 05 41.70	179 05 50.89	4.3165002

KEPHART, CLEARFIELD COUNTY.

On a cultivated ridge in Decatur Township, 5 miles north of Houtzdale, 6 miles northeast of Osceola, on property of G. W. Kephart, 100 yards east of the main road.

Station mark: A marble post 36 by 6 by 6 inches, set 26 inches in the ground, in the center of top of which is cemented a bronze triangulation tablet.

[Latitude $40^{\circ} 52' 57.335''$. Longitude $78^{\circ} 20' 43.265''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Spangle	44 32 17.97	224 25 42.57	4.3060350
Patterson	80 01 58.69	259 51 20.07	4.3657805
Davis	109 40 29.30	289 29 06.67	4.4129932
Neeper	126 58 54.43	306 51 00.30	4.3257634
Kyler	187 56 52.64	7 57 26.54	3.9415908
Pardee	232 11 13.41	52 17 52.35	4.2556682
Morrisdale	234 39 37.03	54 44 23.17	4.0976134

KEPHART TREE, CLEARFIELD COUNTY.

(Not occupied.)

A lone chestnut tree on a cultivated ridge, one-fourth mile southeast of and about 12 feet higher than Kephart triangulation station. A good view can be obtained in all directions excepting toward Kyler station.

Station mark: The chestnut signal tree.

[Latitude $40^{\circ} 52' 48.65''$. Longitude $78^{\circ} 20' 24.78''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Patterson	80 51 32.4	260 40 41.7	4.372874
Kephart Δ	121 46 14.1	301 46 02.0	2.706700

KYLER, CLEARFIELD COUNTY.

On a cleared ridge in Boggs Township, 3 miles west of Wallacetown, 9 miles southeast of Clearfield, owned by Mr. Kyler, who lives on southeast side of ridge. View toward the southeast is partly obstructed by a timbered ridge 1 mile distant, and toward the west is obstructed to a small extent by scattering trees on a ridge one-half mile distant; an extended view can be had in other directions.

Station mark: A marble post 24 by 6 by 6 inches, set in a bed of concrete resting on solid rock; in center of top of post is cemented a bronze triangulation tablet.

[Latitude $40^{\circ} 57' 37.99''$. Longitude $78^{\circ} 19' 51.575''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Kephart.....	7 57 26.54	187 56 52.64	3.9415908
Patterson.....	62 14 27.84	242 03 14.88	4.4346841
Davis.....	90 08 07.96	269 56 10.89	4.4078921
Neeper.....	102 41 37.88	282 33 09.45	4.2689259
Girard.....	179 05 50.89	359 05 41.70	4.9165002
Pardee.....	259 37 11.67	79 43 16.98	4.1219412

M'DOWELL, CLEARFIELD COUNTY.

(Not occupied.)

On a comparatively low cleared hill in Bradford Township, 10 miles east-northeast of Clearfield, on land owned by R. L. McDowell. A good view can be had in all directions excepting southward.

Station mark: A marble post 38 by 6 by 6 inches, set 30 inches in the ground, 1 foot south of fence. In the center of top of post is cemented a bronze triangulation tablet.

Reference mark: A big lone chestnut tree; azimuth from station mark, $256^{\circ} 47'$; distance, 7.4 feet.

[Latitude $41^{\circ} 02' 21.35''$. Longitude $78^{\circ} 18' 28.52''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Neeper.....	76 56 18.75	256 46 55.41	4.3137579
Girard.....	169 18 18.96	349 17 10.17	4.0861395

MORRISDALE, CLEARFIELD COUNTY.

(Not occupied.)

The tower of the large brick school building at Morrisdale, 4 miles north of Philipsburg.

Station mark: Center of tower.

[Latitude $40^{\circ} 56' 51.88''$. Longitude $78^{\circ} 13' 26.61''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Kephart.....	54 44 23.17	234 39 37.03	4.0976134
Kyler.....	99 00 50.19	278 56 37.86	3.9597614
Pardee.....	226 39 50.74	46 41 43.62	3.7430580

NEEPER, CLEARFIELD COUNTY.

On a cultivated flat ridge in Pike Township, 2 miles northwest of Curwensville, owned by R. R. Neeper, who lives on southeast side of ridge. A fine view can be had in all directions excepting northwest.

Station mark: A marble post 36 by 6 by 6 inches, set 30 inches in the ground, in the center of top of which is cemented a bronze triangulation tablet.

Reference mark: The chestnut signal tree; azimuth $74^{\circ} 54'$; distant from station mark 8.5 feet.

[Latitude $40^{\circ} 59' 49.58''$. Longitude $78^{\circ} 32' 46.88''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Patterson.....	19 25 37.98	199 22 52.62	4.2499421
Davis.....	61 31 41.88	241 28 13.00	3.9280619
Girard.....	226 46 37.18	46 54 57.36	4.3867337
McDowell.....	256 46 55.41	76 56 18.75	4.3137579
Kyler.....	282 33 09.45	102 41 37.88	4.2689259
Kephart.....	306 51 00.30	126 58 54.43	4.3257634

PARDEE, CLEARFIELD COUNTY.

In Morris Township, 1 mile south of Kylertown, 2 miles north of Munson, on property of the Pardee Coal Company, 20 feet east of road at a point 150 yards south of forks of road.

Station mark: An oak tree trimmed up, 10 feet east of north and south fence and 2 feet south of east and west fence.

[Latitude $40^{\circ} 58' 54.96''$. Longitude $78^{\circ} 10' 34.43''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Morrisdale	46 41 43.62	226 39 50.74	3.7480580
Kephart	52 17 52.35	232 11 13.41	4.2556682
Kyler	79 43 16.98	259 37 11.67	4.1219412
Girard	144 02 38.44	323 56 18.24	4.3556921

PATTERSON, CLEARFIELD COUNTY.

On a cultivated round hill owned by Lyman Patterson, 3 miles east of Lajose, one-half mile south of Marron, and on line between Ferguson and Jordan townships. Station is on fence line where it crosses summit of hill.

Station mark: A sandstone post 38 by 6 by 6 inches, set 34 inches in the ground, in the center of top of which is cemented a bronze triangulation tablet.

[Latitude $40^{\circ} 50' 45.92''$. Longitude $78^{\circ} 36' 59.335''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Swope	9 02 00.04	189 00 38.52	4.2712711
Beck	76 05 32.70	256 00 42.07	4.0306219
Walls	122 39 55.61	302 33 45.19	4.1967302
Davis	173 04 44.35	353 04 01.09	4.1079136
Neeper	199 22 52.62	19 25 37.98	4.2499421
Kyler	242 03 14.88	62 14 27.84	4.4346841
Kephart	259 51 20.07	80 01 58.69	4.3657805
Spangle	319 59 51.10	140 03 53.63	4.1317818

SPANGLE, CLEARFIELD COUNTY.

On the northern end of a cultivated ridge in Beccaria Township, $1\frac{1}{2}$ miles northeast of Coalport, on land owned by Levi Spangle, and about 300 yards east of his residence. View is unobstructed from southwest round by west to the northeast; timber cuts off eastward view.

Station mark: A sandstone post 36 by 6 by 6 inches, set 26 inches in the ground, and on the fence line. In the center of top of post is cemented a bronze triangulation tablet.

[Latitude $40^{\circ} 45' 09.40''$. Longitude $78^{\circ} 30' 48.17''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Swope -----	55 20 18.75	235 14 55.19	4.1511289
Patterson -----	140 03 53.63	319 59 51.10	4.1317818
Davis -----	156 08 17.51	336 03 31.50	4.4027012
Kephart -----	224 25 42.57	44 32 17.97	4.3060350

WALLS, CLEARFIELD COUNTY.

In a cleared field owned by Andrew Walls, in Bell Township, one-half mile northwest of Newtonburg and 5 miles northwest of Mahaffey, 300 yards northwest of Mr. Walls's house. The view is unobstructed east and south, but is cut off toward the west by a flat timbered ridge.

Station mark: A marble post 36 by 6 by 6 inches, set 30 inches in the ground, in the center of top of which is cemented a bronze triangulation tablet.

[Latitude $40^{\circ} 55' 20.76''$. Longitude $78^{\circ} 46' 25.26''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Davis -----	249 59 03.01	70 04 30.56	4.0948567
Patterson -----	302 33 45.19	122 39 55.61	4.1967302
Beck -----	345 34 28.28	165 35 47.75	4.0578282

BOWSER, JEFFERSON COUNTY.

On a cultivated ridge in the extreme southeastern corner of Gasskill Township, 6 miles northwest of Mahaffey, on land owned by Peter Bowser. Station is near the northeastern end of ridge, 4 or 5 feet lower than the summit, and on the fence line.

Station mark: A sandstone post 34 by 6 by 6 inches, set 30 inches in the ground, in the center of top of which is cemented a bronze triangulation tablet.

[Latitude $40^{\circ} 54' 48.17''$. Longitude $78^{\circ} 49' 16.89''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Beck -----	325 40 06.05	145 43 17.82	4.0855574
Swope -----	330 56 55.20	151 03 35.51	4.4717489

MARYLAND.

PRIMARY TRAVERSE.

The Ellicott and Westminster quadrangles were controlled by 80 miles of primary traverse which, beginning near the southwest corner of Baltimore City, follows the electric railway to Ellicott City, thence along highways to Glenelg post-office, thence northward approximately on the seventy-seventh meridian to the Maryland-Pennsylvania boundary line, thence eastward along this line to the Western Maryland Railroad crossing, where it was connected with line run by Mr. Hall in 1899. A line was also run along the Western Maryland Railroad from Westminster to Glyndon. This work was executed by Mr. E. L. McNair, topographer, in April, 1902.

Geographic positions along the electric road, Baltimore to Ellicott City, thence westward along highways to Glenelg post-office, thence northward to Westminster.

Station.	Latitude.	Longitude.
Baltimore, intersection of Yale avenue and Frederick pike	39 16 54.53	76 41 09.45
Catonsville, opposite First National Bank	39 16 19.8	76 43 53.9
Rolling road and electric railway crossing	39 16 25.9	76 45 24.1
Road and electric railway crossing	39 16 25.6	76 46 42.9
Ellicott City, opposite Howard House, at junction Clarksville and Frederick pikes	39 16 03.2	76 47 53.4
Road east, telephone line	39 15 21.1	76 49 12.7
Columbia post-office, road, four corners	39 14 23.5	76 50 15.9
Road north	39 14 08.4	76 52 07.2
Forks of road, west and northwest	39 14 01.5	76 53 48.5
Patuxent River, middle branch	39 14 39.7	76 54 36.4
Road crossing, telephone line	39 14 59.2	76 55 56.4
Triadelphia pike on north	39 15 52.7	76 58 52.9
Glenelg, Providence M. E. Church, bronze tablet in southeast corner	39 15 37.2	77 00 37.1
Glenwood post-office and store	39 17 14.0	77 01 43.0
Frederick pike, crossing	39 19 14.5	77 01 11.5
Baltimore and Ohio Railroad crossing	39 21 10.6	77 00 57.4
Road west	39 23 09.5	77 01 10.2
Berrett post-office, four corners	39 24 26.4	77 00 59.8
Liberty pike crossing	39 25 46.2	77 00 30.8
Road east	39 27 25.7	77 00 14.9
Morgan Run crossing	39 28 49.8	77 00 14.5
Road intersection	39 29 37.7	76 59 55.2
Fenby post-office and tollgate	39 32 13.9	76 59 41.0

Geographic positions along the Western Maryland Railroad between Westminster and Glyndon.

Station.	Latitude.	Longitude.
Westminster, road crossing, 1 mile northeast of	39 35 02.9	76 58 25.8
Tannery, road crossing	39 34 18.8	76 57 00.4
Carrollton, road crossing at station	39 33 23.6	76 55 10.2
Patapsco, road crossing at station	39 32 19.6	76 53 42.3
Road crossing	39 31 46.6	76 52 58.1
Finksburg, road crossing at station	39 29 59.7	76 52 50.4
Glen Falls, road crossing at station	39 29 38.2	76 52 07.5
Glen Morris, road crossing at station	39 28 59.6	76 49 42.5
Glyndon, road crossing 150 feet north of station	39 28 30.4	76 49 12.8

Geographic positions along highways between Westminster and Maryland-Pennsylvania boundary line.

Station.	Latitude.	Longitude.
Westminster, Western Maryland Railroad crossing	39 34 30.42	76 59 45.68
Westminster, tollgate, 1 mile north of	39 35 31.0	76 59 57.4
Mount Pleasant Hotel, road west	39 38 15.8	77 00 22.4
Road east	39 39 45.6	77 00 49.6
Road east	39 41 15.6	77 00 41.1

Geographic positions along Maryland-Pennsylvania boundary line.

Station.	Latitude.	Longitude.
Road west, on State line	39 43 13.0	77 00 20.4
Boundary post	39 43 13.0	76 59 42.3
Boundary post	39 43 13.2	76 58 34.7
Boundary post in wheat field	39 43 13.5	76 57 26.9
Boundary post in wheat field	39 43 13.6	76 56 19.6
Boundary post at roadside	39 43 13.8	76 55 11.4
Boundary post	39 43 14.0	76 54 08.3
Boundary post	39 43 14.2	76 52 55.7
Boundary post in wheat field	39 43 14.3	76 51 47.9
Western Maryland Railroad crossing (junction with Hall's line of 1899)	39 43 14.55	76 50 43.64
Boundary post 240 feet east of Western Maryland Railroad crossing	39 43 14.45	76 50 40.48

NORTH CAROLINA.

PRIMARY TRAVERSE.

The following positions for the control of ten 15-minute quadrangles in the east-central portion of the State were obtained from primary traverse in March and April, 1902, by Mr. Sledge Tatum, topographer.

The line begins at the main line crossing, South Rockymount, located by Mr. Oscar Jones in 1900, and runs westward along the Atlantic Coast Line Railroad to Nashville; thence along highways to Forestville; thence along the Seaboard Air Line Railway to Raleigh; thence along the Southern Railway to Goldsboro and connected with the south meridian stone. A spur line follows the Atlantic Coast Line Railroad from Goldsboro southward to Dudley. A line approximately on the parallel of $35^{\circ} 30'$ follows the highways between Princeton and Ayden, and another line follows the highways from Conetoe via Wilson to Raleigh.

Geographic positions along the Atlantic Coast Line Railroad from Rockymount to Nashville.

Station.	Latitude.	Longitude.
South Rockymount, main line junction	° ' "	° ' "
Road crossing	35 55 51.7	77 48 02.5
Road crossing	35 57 03.5	77 50 00.3
Road crossing	35 57 30.0	77 52 21.3
Road crossing	35 57 47.7	77 53 55.8
Road crossing	35 57 52.1	77 55 09.1
Road crossing	35 58 03.7	77 57 12.0
Nashville station	35 58 06.3	77 58 18.4

Geographic positions along highways between Nashville and Wake Forest.

Station.	Latitude.	Longitude.
Road left	° ' "	° ' "
Road right	35 58 25.1	78 00 42.3
Road left	35 59 37.6	78 02 17.5
Road left	35 59 28.2	78 03 12.8
Road left	35 59 02.6	78 03 43.4
Hunts Cross Roads	35 59 30.0	78 07 32.3
Creek left	35 58 49.3	78 08 10.5
Road left	35 57 43.7	78 09 06.8
Road left	35 56 53.6	78 10 20.7
Tar River, center of	35 56 27.3	78 12 10.5
Road left	35 56 58.6	78 14 08.0
Road right	35 57 23.6	78 14 56.8
Halls Cross Roads	35 58 55.9	78 15 52.4
<i>Road left</i>	35 58 09.3	78 17 14.0

Geographic positions along highways between Nashville and Wake Forest—Cont'd.

Station.	Latitude.	Longitude.
Road left	° ' "	° ' "
Bakers, road crossing at	35 57 42.0	78 17 27.4
Road crossing	35 56 52.5	78 18 46.4
Road crossing	35 58 34.6	78 21 00.6
Road crossing	35 58 54.8	78 22 55.9
Road crossing	35 59 48.0	78 25 00.0
Mays Cross Roads	36 00 54.2	78 26 27.0
Road crossing	36 00 20.7	78 28 42.6
Road crossing	35 59 03.8	78 30 20.6

Geographic positions along the Seaboard Air Line Railway from Wake Forest to Raleigh.

Station.	Latitude.	Longitude.
Forestville station	° ' "	° ' "
Road crossing	35 57 42.4	78 30 57.7
Wyatt station	35 56 35.3	78 31 33.5
Flat River	35 55 48.6	78 32 18.6
Neuse station	35 54 34.7	78 33 26.0
Road crossing	35 53 49.2	78 34 07.0
Road crossing	35 53 01.8	78 34 35.8
Road crossing	35 51 45.1	78 35 44.5
Millbrook station	35 51 00.7	78 36 10.3
Road crossing	35 50 02.3	78 36 19.5
Road crossing	35 48 15.0	78 37 25.3
Raleigh, Union station	35 46 37.7	78 38 39.7
Raleigh, capitol dome	35 46 48.4	78 38 18.0

Geographic positions along the Southern Railway from Raleigh to Goldsboro.

Station.	Latitude.	Longitude.
Creek left	° ' "	° ' "
Road crossing	35 45 23.2	78 38 00.9
Garner station	35 42 59.6	78 37 26.9
Auburn station	35 42 22.6	78 36 11.0
Road crossing	35 41 38.0	78 33 19.8
Road crossing	35 40 49.1	78 31 19.7
Road crossing	35 39 55.8	78 28 23.5
Road crossing	35 38 22.1	78 26 45.4
Road crossing	35 36 59.7	78 24 32.4
Wilson Mills station	35 35 00.2	78 21 18.4
Neuse River	35 33 31.3	78 19 13.3

40 PRIMARY TRIANGULATION AND PRIMARY TRAVERSE. [BULL. 201.

Geographic positions along the Southern Railway from Raleigh to Goldsboro—Continued.

Station.	Latitude.	Longitude,
Road crossing	35 22 45.5	78 18 14.8
Selma, crossing Atlantic Coast Line R. R.	35 31 56.2	78 16 45.6
Pinelevel station	35 30 45.3	78 14 37.1
Road crossing	35 29 28.6	78 12 18.5
Road crossing	35 28 51.7	78 11 11.8
Road crossing	35 27 53.7	78 09 27.2
Whitneys crossing	35 26 26.7	78 06 50.3
Rose station	35 25 00.1	78 04 14.5
Road crossing	35 24 07.0	78 02 55.0
Weils station	35 22 47.0	78 01 07.4

Geographic positions along the Atlantic Coast Line Railroad between Goldsboro and Dudley.

Station.	Latitude.	Longitude.
Genoa station	35 19 37.7	78 01 49.6
Dudley station	35 15 58.2	78 02 13.0

Geographic positions along highways between Princeton, Pikeville, and Ayden.

Station.	Latitude.	Longitude.
Princeton crossing	35 27 57.7	78 09 34.4
Little River, bridge over	35 28 55.0	78 08 36.9
Road right	35 29 02.9	78 06 07.4
Road right	35 29 12.2	78 04 17.8
Crossroads	35 29 47.4	78 01 58.8
Road left	35 29 28.1	78 00 22.2
Pikeville station, Atlantic Coast Line R. R. crossing, 310 feet south of	35 29 49.5	77 58 57.7
Road right	35 30 00.4	77 57 44.3
Crossroads	35 30 04.5	77 56 38.8
Crossroads	35 29 47.2	77 55 40.1
Aycocks Mill, road right	35 30 06.6	77 53 52.8
Road left	35 31 50.0	77 54 02.3
Eureka crossroads	35 32 32.9	77 52 32.0
Faro post-office	35 30 47.3	77 50 45.2
Road right	35 29 58.4	77 49 28.0
Bullhead post-office	35 29 18.3	77 47 48.1
Crossroads	35 28 39.2	77 43 59.2

Geographic positions along highways between Princeton, Pikeville, and Ayden—Continued.

Station.	Latitude.	Longitude.
Road right	° ' "	° ' "
Crossroads	35 27 00.3	77 40 52.1
Road left	35 28 44.7	77 38 50.5
Road left	35 28 47.9	77 37 46.1
Snowhill, Greene County court-house	35 27 17.7	77 40 12.7
Road left	35 28 53.0	77 38 14.9
Dixonville post-office	35 28 14.8	77 36 35.4
Road right	35 28 22.3	77 35 17.8
Road left	35 29 04.5	77 35 05.8
Ormondsville crossroads	35 28 14.3	77 32 45.6
Road right	35 27 53.2	77 31 01.2
Ridge Spring post-office	35 27 22.9	77 29 19.4
Road left	35 28 04.5	77 28 58.9
Road left	35 28 27.8	77 27 58.3
Tramway crossing	35 28 33.4	77 26 31.5

Geographic positions along highways between Conetoe and Wilson

Station.	Latitude.	Longitude.
Conetoe station	° ' "	° ' "
Road right	35 48 56.5	77 27 19.7
Road left	35 48 16.1	77 30 04.4
Old Sparta post-office	35 47 44.4	77 32 06.4
Pitt-Edgecombe county line	35 47 21.6	77 33 18.3
Road left	35 44 52.7	77 32 33.7
Road left	35 44 16.0	77 32 29.1
Creek left	35 44 08.9	77 33 38.2
Crossroads	35 43 55.2	77 35 29.9
Crisp post-office, crossroads at	35 45 08.9	77 37 33.2
Road right	35 44 31.6	77 39 08.6
East Carolina Railway crossing	35 44 14.8	77 40 07.8
Road left	35 43 54.5	77 42 08.2
Road left	35 43 36.2	77 43 16.5
Road left	35 42 14.2	77 44 55.9
Crossroads	35 42 22.6	77 46 57.0
Crossroads	35 41 46.3	77 49 02.5
Road right	35 41 47.3	77 50 49.3
Road left	35 42 09.5	77 52 23.3
Wilson, railroad crossing	35 43 20.6	77 54 25.5
Wilson station, Atlantic Coast Line R. R.	35 43 21.9	77 54 24.5

Geographic positions along highways between Wilson and Raleigh.

Station.	Latitude.	Longitude.
Road left	° ' "	° ' "
	35 43 10.0	77 57 04.7
Crossroads	35 43 29.8	77 59 44.9
Crossroads	35 43 50.1	78 01 47.5
Road left	35 44 25.3	78 03 41.5
Talbot post-office	35 44 12.2	78 05 37.5
Road left	35 44 31.4	78 07 29.9
Connor post-office	35 44 28.1	78 09 03.4
Road left	35 44 16.2	78 10 39.8
Road left	35 4 15.4	78 11 51.7
Road right	35 46 26.7	78 13 34.5
Road left	35 46 39.4	78 16 04.4
Crossroads	35 46 49.6	78 17 18.5
Road right	35 47 12.0	78 18 15.3
Road right	35 46 56.8	78 19 32.6
Road left	35 46 55.3	78 21 41.8
Road right	35 48 06.2	78 24 02.5
Eagle Rock post-office	35 48 14.7	78 25 21.5
Road left	35 47 59.7	78 28 16.1
Crossroads	35 47 52.8	78 29 12.0
Road right	35 48 00.3	78 32 11.1
Road left	35 47 52.7	78 33 35.2
Road left	35 47 12.2	78 35 25.7

OHIO.**PRIMARY TRAVERSE.**

During the month of October, 1901, Mr. Sledge Tatum, topographer, controlled, by means of 140 miles of primary traverse, four quadrangles in the north-central portion of the State, in Lorain, Huron, Medina, Richland, Ashland, and Wayne counties.

The traverse is based upon Camden and Townsend triangulation stations of the United States lake survey and on points near Millbrook and Burbank, established in 1900 from primary traverse by Mr. E. L. McNair.

Geographic positions along Baltimore and Ohio Railroad (Lodi and Wooster branch) from Erie Railroad crossing to Lodi.

Station.	Latitude.	Longitude.
Erie and Baltimore and Ohio R. R. crossing	° ' "	° ' "
	40 59 19.4	82 01 33.7
Burbank, 2 miles west of, road crossing	41 00 04.6	82 01 09.0

Geographic positions along Baltimore and Ohio Railroad (main line) from Lodi to Greenwich.

Station.	Latitude.	Longitude.
Lodi, junction main line and branch, point 70 feet west of tool house	41 01 39.3	82 01 04.6
Road crossing	41 00 51.8	82 02 48.0
Road crossing	41 00 51.6	82 03 17.7
Road crossing	41 00 49.5	82 04 41.5
Road crossing	41 01 05.0	82 05 50.6
Homer station, road crossing 770 feet east of	41 01 08.6	82 07 16.4
Road crossing	41 01 32.4	82 08 44.1
Road crossing	41 01 50.2	82 09 49.6
Road crossing	41 01 54.2	82 12 06.0
Sullivan station, road crossing west of	41 01 55.0	82 13 20.4
Road crossing	41 01 56.3	82 15 36.6
Road crossing	41 01 57.0	82 16 50.3
Road crossing	41 01 57.9	82 18 18.8
Road crossing	41 02 33.7	82 20 46.1
Road crossing	41 03 19.4	82 22 32.7
Hereford station	41 03 34.3	82 23 37.9
Rumley station	41 03 03.7	82 26 08.7
Road crossing	41 02 17.3	82 29 09.8
Road crossing	41 02 05.9	82 30 01.0
Greenwich station, street crossing 100 feet east of	41 02 04.7	82 30 40.1

Geographic positions along highways from Greenwich to Mansfield.

Station.	Latitude.	Longitude.
Road west	41 00 40.6	82 30 36.0
United Brethren Church	40 59 35.0	82 30 28.0
Crossroads	40 59 34.1	82 29 13.2
Crossroads	40 58 31.7	82 29 32.8
Road east	40 57 11.9	82 29 42.3
Crossroads	40 56 19.0	82 29 41.6
Road east	40 55 25.3	82 29 51.4
Shenandoah, crossroads at	40 54 42.6	82 29 58.0
Road west	40 53 41.0	82 30 16.6
Road west	40 53 07.5	82 30 47.3
Road east	40 52 21.4	82 30 50.4
Crossroads	40 50 53.7	82 30 49.0
Road west	40 49 19.8	82 30 47.9
Road east	40 47 55.5	82 30 48.5
Mansfield, flagstaff of State reformatory	40 46 57.6	82 30 11.1

44 PRIMARY TRIANGULATION AND PRIMARY TRAVERSE. [BULL. 201.

Geographic positions along highways from Mansfield to Millbrook via Hayesville.

Station.	Latitude.	Longitude.
Road crossing	40 45 28.1	82 29 39.9
Road crossing	40 45 37.7	82 28 28.8
Road south	40 45 56.7	82 27 19.6
Road south	40 45 56.6	82 26 16.4
Brick schoolhouse	40 45 57.5	82 25 40.3
Road crossing	40 46 02.2	82 23 51.9
Petersburg, road crossing at	40 46 25.1	82 21 50.0
Road crossing	40 46 22.5	82 20 22.7
Road south	40 46 19.3	82 18 58.2
Road south	40 46 19.6	82 17 15.9
Hayesville, street crossing at	40 46 21.6	82 16 02.7
Road north	40 46 18.8	82 13 52.3
Road south	40 46 18.1	82 12 46.6
Road crossing	40 46 14.0	82 11 04.4
Road north	40 45 41.6	82 09 23.3
Lakefork, forks of road at	40 44 54.8	82 08 26.5
Road crossing	40 45 13.7	82 06 50.8
Blachleyville, street crossing at	40 45 51.0	82 04 54.7
Road crossing	40 44 43.3	82 02 52.8
Road north	40 43 51.4	82 00 26.9
Pittsburg, Fort Wayne and Chicago Rwy. bridge No. 121, near Millbrook; copper bolt in bridge abutment at northwest corner of	40 43 51.9	81 51 24.6

Geographic positions along highways from a point about 4½ miles east of Hayesville northward, via Polk, Sullivan, and Wellington, to Camden triangulation station of United States Lake Survey.

Station.	Latitude.	Longitude.
Ashland and Wooster Rwy., crossing of	40 47 57.9	82 11 37.8
Crossroads	40 49 39.8	82 12 37.3
Crossroads	40 52 15.7	82 12 42.6
Crossroads	40 54 03.7	82 12 48.3
Polk, Erie R. R. crossing	40 57 00.7	82 12 53.9
Crossroads	40 58 25.9	82 12 55.2
Crossroads	40 59 31.7	82 13 23.6
Sullivan, bronze tablet in public school building	41 01 47.3	82 13 07.6
Sullivan, Baltimore and Ohio R. R. crossing	41 01 55.0	82 13 20.4
Crossroads	41 03 27.8	82 13 16.3
Crossroads	41 05 04.8	82 13 16.2

Geographic positions along highways from a point about 4½ miles east of Hayesville northward, via Polk, Sullivan, and Wellington, to Camden triangulation station of United States Lake Survey—Continued.

Station.	Latitude.	Longitude.
Road east	41 06 58.5	82 13 12.2
Crossroads	41 08 52.3	82 13 06.0
Wellington station, Wheeling and Lake Erie R. R.	41 09 48.2	82 13 29.9
Wheeling and Lake Erie R. R., crossing of	41 10 10.1	82 16 31.0
Brighton, crossroads at	41 10 15.8	82 18 34.1
Road west	41 12 55.1	82 18 22.6
Lake Shore and Michigan Southern Rwy., crossing of	41 16 04.3	82 18 08.7
Camden triangulation station, United States Lake Survey	41 16 26.0	82 17 46.7

Geographic positions along highways from Townsend triangulation station of the United States Lake Survey south to Greenwich.

Station.	Latitude.	Longitude.
Townsend triangulation station, United States Lake Survey	41 15 43.5	82 29 00.6
Lake Shore and Michigan Southern Rwy., crossing of	41 15 29.0	82 29 31.0
Road east	41 13 19.0	82 29 29.9
Crossroads	41 10 31.0	82 29 25.6
Road west	41 08 40.1	82 30 51.2
Road west	41 07 49.0	82 31 13.2
Crossroads	41 06 08.6	82 30 49.6
Road east	41 03 53.4	82 30 44.8
Greenwich, bronze tablet in base of standpipe at city waterworks	41 01 37.3	82 31 13.5

CENTRAL SECTION OF TOPOGRAPHY.

OHIO.

PRIMARY TRAVERSE.

Thirty 15-minute quadrangles, covering portions of 18 counties in the northwestern portion of the State, were controlled by 160 miles of primary traverse along railways by Mr. George T. Hawkins, topographer, supplemented by 700 miles of traverse run by Mr. J. R. Ellis along highways, following meridians and parallels as closely as practicable.

The following geographic positions were determined from primary traverse in 1901 by Mr. George T. Hawkins, topographer.

The line starts from a point in the western part of the city of Toledo and follows the Lake Shore Railway to Edgerton, thence southwest via highways to the Indiana-Ohio State line, thence south along the State line to the Findlay, Fort Wayne and Western Railway, thence along that railway to Findlay, where it was connected with a line run in 1900.

Geographic positions along Lake Shore and Michigan Southern Railway, between Toledo and Edgerton.

Station.	Latitude.	Longitude.
Toledo, crossing of Michigan Central and Toledo, St. Louis and Western railroads	41 37 33.5	83 34 23.2
Mileposts 4 and 5, north and south road crossing between	41 38 01.4	83 36 23.6
Mileposts 5 and 6, north and south road crossing between	41 37 50.4	83 37 32.6
Mileposts 6 and 7, north and south road crossing between	41 37 39.3	83 38 42.4
Mileposts 7 and 8, north and south road crossing between	41 37 28.2	83 39 52.0
Milepost 8, $\frac{1}{2}$ mile east of east and west road crossing	41 37 24.7	83 40 13.4
Mileposts 8 and 9, north and south road crossing between	41 37 17.0	83 41 01.8
Holland, north and south road crossing east of	41 37 05.9	83 42 11.3
Holland station	41 37 00.8	83 42 43.2
Holland, road crossing west of	41 37 00.2	83 42 47.1
Mileposts 11 and 12, north and south road crossing between	41 36 46.3	83 44 14.0
Milepost 12, east and west road crossing west of	41 36 35.3	83 45 22.6
Mileposts 12 and 13, north and south road crossing between	41 36 32.4	83 45 40.3
Mileposts 13 and 14, east and west road crossing between	41 36 24.2	83 46 31.4
Mileposts 14 and 15, east and west road crossing between	41 36 11.7	83 47 49.6

Geographic positions along Lake Shore and Michigan Southern Railway, between Toledo and Edgerton--Continued.

Station.	Latitude.	Longitude.
Mileposts 16 and 17, north and south road crossing between	41 35 55.9	83 49 27.6
Mileposts 17 and 18, north and south road crossing between	41 35 44.4	83 50 39.1
Mileposts 18 and 19, north and south road crossing between	41 35 33.3	83 51 47.7
Mileposts 18 and 19, north and south road crossing between	41 35 22.3	83 52 55.9
Swanton station	41 35 18.1	83 53 22.0
Swanton, main street crossing	41 35 17.5	83 53 25.9
Mileposts 20 and 21, north and south road crossing between	41 35 11.0	83 54 05.6
Mileposts 20 and 21, north and south road crossing between	41 35 03.3	83 54 53.5
Mileposts 21 and 22, north and south road crossing between	41 34 59.7	83 55 15.6
Mileposts 22 and 23, north and south road crossing between	41 34 48.2	83 56 26.9
Mileposts 23 and 24, north and south road crossing between	41 34 31.3	83 58 11.0
Mileposts 24 and 25, east and west road crossing between	41 34 25.2	83 58 48.3
Delta station	41 34 14.8	83 59 52.9
Delta, road crossing west of	41 34 14.5	83 59 54.8
Delta, road crossing west of	41 34 13.4	84 00 01.7
Delta, road crossing west of	41 34 11.7	84 00 11.9
Road crossing, northeast and southwest	41 34 01.8	84 01 13.0
Mileposts 27 and 28, north and south road crossing between	41 33 51.8	84 02 14.4
Mileposts 28 and 29, north and south road crossing between	41 33 40.6	84 03 23.5
Mileposts 29 and 30, north and south road crossing between	41 33 29.2	84 04 33.6
Mileposts 31 and 32, north and south road crossing between	41 33 06.6	84 06 52.6
Mileposts 32 and 33, north and south road crossing between	41 32 55.1	84 08 02.9
Wauseon, main street crossing	41 32 51.1	84 08 27.3
Wauseon station	41 32 49.7	84 08 35.9
Wauseon, crossing Lake Shore and Detroit Southern railroads	41 32 47.2	84 08 51.7
Wauseon Cemetery, north and south road crossing at	41 32 44.0	84 09 11.2
Milepost 34, east and west road crossing at	41 32 37.5	84 09 50.9
Mileposts 34 and 35, north and south road crossing between	41 32 32.7	84 10 20.5
Mileposts 35 and 36, north and south road crossing between	41 32 21.4	84 11 28.9

Geographic positions along Lake Shore and Michigan Southern Railway, between Toledo and Edgerton—Continued.

Station.	Latitude.	Longitude.
Mileposts 36 and 37, north and south road crossing between	41 32 10.0	84 12 39.4
Mileposts 37 and 38, north and south road crossing between	41 31 59.3	84 13 44.7
Mileposts 38 and 39, north and south road crossing between	41 31 48.0	84 14 53.7
Mileposts 38 and 39, east and west road crossing between	41 31 42.7	84 15 26.3
Mileposts 39 and 40, north and south road crossing between	41 31 36.7	84 16 02.7
Mileposts 40 and 41, north and south road crossing between	41 31 25.3	84 17 12.0
Archbold station	41 31 15.3	84 18 12.7
Archbold, main street crossing	41 31 13.8	84 18 21.7
Mileposts 42 and 43, north and south road crossing between	41 31 02.4	84 19 31.1
Mileposts 43 and 44, north and south road crossing between	41 30 52.7	84 20 30.2
Milepost 45, north and south road crossing near	41 30 35.5	84 22 14.4
Mileposts 45 and 46, north and south road crossing between	41 30 27.2	84 23 04.7
Mileposts 46 and 47, north and south road crossing between	41 30 18.3	84 23 58.8
Stryker, main street crossing	41 30 09.8	84 24 50.5
Stryker station	41 30 08.4	84 24 58.8
Milepost 48, north and south road crossing near	41 30 02.7	84 25 33.1
Mileposts 48 and 49, north and south road crossing between	41 29 57.5	84 26 04.8
Milepost 49, north and south road crossing near	41 29 49.8	84 26 51.5
Mileposts 49 and 50, north and south road crossing between	41 29 43.2	84 27 31.2
Milepost 50 and 51, north and south road crossing between	41 29 32.1	84 28 38.3
Mileposts 51 and 52, north and south road crossing between	41 29 20.6	84 29 47.9
Milepost 52, road crossing near	41 29 14.1	84 30 26.6
Milepost 53, road crossing near	41 29 06.3	84 31 14.2
Road crossing, northeast and southwest	41 29 01.2	84 31 44.6
Mileposts 53 and 54, north and south road crossing between	41 28 57.1	84 32 09.7
Lake Shore and Cincinnati Northern Railroad crossing	41 28 53.5	84 32 31.5
Bryan, road crossing at	41 28 49.2	84 32 57.4
Bryan, road crossing at	41 28 48.4	84 33 01.9
Bryan station	41 28 48.0	84 33 04.3
Road crossing over railroad	41 28 35.3	84 34 21.0

*Geographic positions along Lake Shore and Michigan Southern Railway,
between Toledo and Edgerton—Continued.*

Station.	Latitude.	Longitude.
Mileposts 56 and 57, north and south road crossing between	° ' "	° ' "
	41 28 23.0	84 35 35.2
Road crossing over railroad	41 28 11.3	84 36 45.4
Milepost 59, north and south road crossing near	41 27 59.9	84 37 54.5
Mulberry station	41 27 48.9	84 39 00.7
Milepost 60, north and south road crossing near	41 27 48.6	84 39 02.6
Road crossing over railroad	41 27 36.6	84 40 14.4
Milepost 62, north and south road crossing near	41 27 24.7	84 41 26.5
Mileposts 62 and 63, north and south road crossing between	41 27 20.6	84 41 51.5
Milepost 63, north and south road crossing near	41 27 13.0	84 42 37.2
Milepost 64, north and south road crossing near	41 27 01.8	84 43 45.3
Edgerton, road crossing at	41 26 53.9	84 44 32.7
Edgerton station	41 26 52.4	84 44 42.1
Edgerton, main street crossing	41 26 50.8	84 44 51.5

*Geographic positions along highways between Edgerton and Ohio-Indiana State
line.*

Station.	Latitude.	Longitude.
T. 5 N., R. 1 E., corner secs. 3 and 4, on township line	° ' "	° ' "
	41 25 23.8	84 44 54.7
T. 5 N., R. 1 E., corner secs. 3, 4, 9, and 10	41 24 40.7	84 44 54.2
T. 5 N., R. 1 E., corner secs. 9, 10, 15, and 16	41 23 48.7	84 44 53.3
T. 5 N., R. 1 E., corner secs. 15, 16, 21, and 22	41 22 56.4	84 44 52.5
T. 5 N., R. 1 E., corner secs. 21, 22, 27, and 28	41 22 04.2	84 44 51.6
T. 5 N., R. 1 E., corner secs. 28, 29, 32, and 33	41 21 12.1	84 45 59.2
T. 5 N., R. 1 E., corner secs. 29, 30, 31, and 32	41 21 11.8	84 47 08.8

Geographic positions along Ohio-Indiana State line.

Station.	Latitude.	Longitude.
T. 5 N., R. 1 E., corner on State line between secs. 30 and 31	° ' "	° ' "
	41 21 12.0	84 48 12.5
T. 4 N., R. 1 E., corner secs. 6 and 7	41 19 28.7	84 48 12.3
Road west	41 18 51.2	84 48 12.1
Baltimore & Ohio Railroad crossing	41 18 13.6	84 48 11.7
Roads west and southeast	41 17 59.0	84 48 11.7
Road west	41 17 06.4	84 48 11.3
Road northeast and southwest	41 16 14.6	84 48 10.9
Road west	41 15 22.0	84 48 10.8

Geographic positions along Ohio-Indiana State line—Continued.

Station.	Latitude.	Longitude.
Ts. 3 and 4 N., R. 1 E., township corner.....	41 15 08.2	84 48 10.8
Road west.....	41 14 29.5	84 48 10.7
Road west.....	41 13 37.0	84 48 10.8
T. 3 N., R. 1 E., corner secs. 7 and 18.....	41 13 20.2	84 48 10.9
Road west.....	41 13 11.1	84 48 11.0
T. 3 N., R. 1 E., corner secs. 18 and 19.....	41 12 27.8	84 48 10.9
Road east and west.....	41 11 52.5	84 48 10.9
Road west.....	41 11 05.2	84 48 10.6
Road east.....	41 11 02.1	84 48 10.6
Road east.....	41 09 26.4	84 48 11.1
Wabash Railroad crossing.....	41 08 53.8	84 48 11.0
Road east.....	41 08 11.7	84 48 11.3
Road west.....	41 07 35.6	84 48 11.3
Road east.....	41 07 19.2	84 48 11.3
Road east.....	41 06 26.8	84 48 11.1
Road east.....	41 06 00.5	84 48 11.1
Road west.....	41 05 50.8	84 48 11.1
Ts. 1 and 2 N., R. 1 E., township corner.....	41 04 41.7	84 48 11.1
Road east and west.....	41 04 41.1	84 48 11.1
Road west.....	41 04 06.1	84 48 11.0
T. 1 N., R. 1 E., corner secs. 6 and 7.....	41 03 46.7	84 48 10.9
Road west.....	41 03 13.3	84 48 10.8
T. 1 N., R. 1 E., corner secs. 7 and 18.....	41 02 54.4	84 48 10.6
Road northeast.....	41 02 22.7	84 48 10.8
Road east.....	41 02 01.6	84 48 10.7
Road west.....	41 01 41.8	84 48 10.8
T. 1 N., R. 1 E., corner secs. 19 and 30.....	41 01 09.2	84 48 11.0

Geographic positions along Findlay, Fort Wayne and Western Railway, between Baldwin and Findlay.

Station.	Latitude.	Longitude.
Baldwin station.....	41 01 05.9	84 48 09.5
Road crossing, north and south.....	41 01 06.0	84 47 01.4
Road crossing, north and south.....	41 01 06.0	85 46 27.1
McGill station.....	41 01 06.0	84 46 26.2
Road crossing, north and south.....	41 01 06.1	84 45 35.8
Batson station.....	41 01 06.3	84 44 44.7
Road crossing, north and south.....	41 01 06.4	84 43 35.3
Road crossing, north and south.....	41 01 06.6	84 42 26.0

Geographic positions along Findlay, Fort Wayne and Western Railway, etc.—
Continued.

Station.	Latitude.	Longitude.
	° ' "	° ' "
T. 1 N., Rs. 1 and 2 E., corner secs. 19, 30, 24, and 25.	41 01 09.2	84 41 16.2
Tipton, road crossing at	41 01 07.1	84 40 08.7
Road crossing, north and south	41 01 07.3	84 38 58.4
Road crossing, north and south	41 01 07.5	84 37 49.5
Road crossing, north and south	41 01 07.7	84 36 40.6
Road crossing, north and south	41 01 07.8	84 36 05.9
Road crossing, north and south	41 01 07.9	84 35 31.1
Haviland, railroad crossing at	41 01 08.0	84 34 56.0
T. 1 N., Rs. 2 and 3 E., corner secs. 19, 30, 24, and 25.	41 01 10.0	84 34 21.6
Road crossing, north and south	41 01 08.2	84 33 12.1
Road crossing, north and south	41 01 08.4	84 32 02.9
Road crossing, north and south	41 01 08.6	84 30 53.4
Road crossing, north and south	41 01 08.9	84 29 44.4
Groverhill station	41 01 09.2	84 28 39.0
Groverhill, main street crossing	41 01 09.2	84 28 35.1
T. 1 N., Rs. 3 and 4 E., corner secs. 19, 30, 24, and 25.	41 01 10.7	84 27 26.0
Road crossing, north and south	41 01 10.1	84 25 42.5
Roselmo station	41 01 10.3	84 25 07.4
Road crossing, north and south	41 01 10.7	84 24 58.9
Road crossing, north and south	41 01 10.9	84 23 24.6
Road south	41 01 11.1	84 22 50.1
Erie Canal crossing	41 01 11.6	84 21 31.5
T. 1 N., Rs. 4 and 5 E., corner secs. 19, 30, 24, and 25.	41 01 12.7	84 20 31.7
Road crossing, north and south	41 01 12.4	84 19 22.0
Road crossing, north and south	41 01 12.6	84 18 47.0
Cloverleaf Railroad crossing	41 01 12.9	84 18 12.7
Road crossing, north and south	41 01 13.1	84 17 38.3
Road crossing, northwest and southeast	41 01 13.2	84 17 24.6
Road crossing, under railway	41 01 13.2	84 17 15.1
Road crossing, north and south	41 01 13.7	84 15 54.6
Road crossing, north and south	41 01 13.9	84 15 20.0
Road crossing, north and south	41 01 14.1	84 14 45.4
Rs. 5 and 6 E., road crossing between	41 01 14.5	84 13 36.3
Detroit and Lima Northern Railway crossing	41 01 14.7	84 12 59.0
Criswell station	41 01 15.0	84 11 58.1
Road crossing, north and south	41 01 15.0	84 11 52.7
Road crossing, north and south	41 01 15.4	84 10 18.0
Avis, road crossing at	41 01 15.4	84 10 09.7
Road crossing, north and south	41 01 15.7	84 08 59.7
Road crossing, north and south	41 01 15.8	84 08 25.8
Road crossing, north and south	41 01 15.8	84 08 07.8

Geographic positions along Findlay, Fort Wayne and Western Railway, etc.—Continued.

Station.	Latitude.	Longitude.
Rs. 6 and 7 E., road crossing between	41 01 16.4	84 06 41.2
Road crossing, north and south	41 01 16.8	84 05 32.3
Road crossing, north and south	41 01 17.0	84 04 57.5
Road crossing, north and south	41 01 17.1	84 04 42.1
Glandorf, road crossing at	41 01 17.2	84 04 23.4
Glandorf, road crossing $\frac{1}{4}$ mile east of	41 01 17.4	84 03 48.0
Ottawa, Cincinnati, Hamilton and Dayton Railway crossing	41 01 17.7	84 02 51.0
Ottawa station (Findlay, Fort Wayne and Western Railway)	41 01 17.7	84 02 49.0
Road crossing, north and south	41 01 17.8	84 02 39.4
Detroit Southern Railroad crossing	41 01 17.9	84 02 04.4
Rs. 7 and 8 E., road crossing between	41 01 18.2	83 59 45.3
Pike road crossing	41 01 18.2	83 58 47.0
Road crossing, north and south	41 01 18.8	83 57 27.1
Road crossing	41 01 19.1	83 55 26.1
Gilboa station	41 01 19.1	83 55 19.6
Road crossing, north and south	41 01 19.1	83 55 19.2
Road crossing, north and south	41 01 19.1	83 55 08.9
Road crossing, north and south	41 01 19.2	83 54 16.6
Road crossing, north and south	41 01 19.3	83 53 59.4
Pike road crossing, northeast and southwest	41 01 19.4	83 53 11.0
Road, north and south	41 01 19.5	83 52 50.5
Road crossing, north and south	41 01 19.7	83 51 41.4
Moffits, road crossing at	41 01 19.8	83 50 49.2
Road crossing, north and south	41 01 20.2	83 48 49.2
Benton Ridge, road crossing at	41 01 20.4	83 47 57.0
Benton Ridge, road crossing $\frac{1}{4}$ mile east of	41 01 20.5	83 47 08.0
Rs. 9 and 10 E., road crossing between	41 01 20.7	83 45 55.7
Road, north and south	41 01 20.8	83 45 04.8
Pike road crossing, northeast and southwest	41 01 20.8	83 44 19.6
Road crossing, north and south	41 01 20.7	83 44 13.1
Road crossing, north and south	41 01 20.7	83 43 39.1
Road crossing, north and south	41 01 20.5	83 42 46.5
Road crossing, north and south	41 01 20.4	83 41 54.3
Lake Erie and Western Railroad crossing	41 01 20.4	83 41 00.2
Road crossing, north and south	41 01 20.4	83 40 45.2
Road crossing, northeast and southwest	41 01 20.5	83 40 05.4
Findlay, Main street crossing	41 01 20.5	83 39 01.6
Findlay station	41 01 20.5	83 38 59.5

The following geographic positions were determined from primary traverse run in 1901 by Mr. J. R. Ellis, field assistant:

Geographic positions along highways from Mount Sterling to McCutchenville.

Station.	Latitude.	Longitude.
Mount Sterling, Baltimore and Ohio Railroad and main street crossing	39 43 17.6	83 16 03.7
Roads, north, east, and south	39 45 11.9	83 15 11.1
Loubgert Creek, bridge over	39 47 09.3	83 14 53.1
Wrightsville and Kiousville Pike, 300 feet east of W. McNeill's house	39 48 58.2	83 16 26.2
Wrightsville, cross roads at	39 51 39.3	83 14 52.2
Lilly Chapel and Georgesville, and road north	39 53 18.0	83 15 06.1
Lilly Chapel, Georgesville and West Jefferson cross roads	39 55 51.3	83 16 54.4
National Pike, cross roads on	39 56 45.4	83 15 14.0
Road east	39 58 24.9	83 15 36.0
School house, road southwest at	39 59 53.5	83 15 50.9
Worthington store, road east at	40 02 30.5	83 15 49.9
Road east	40 04 08.1	83 15 05.6
Road east, north, and south	40 05 27.3	83 15 23.4
Pittsburg, Cincinnati, Chicago and St. Louis Railway, crossing of	40 05 43.2	83 14 54.0
Madison and Union counties, stone monument between	40 06 29.8	83 14 01.3
Fork of road northwest	40 09 50.2	83 13 44.1
Schoolhouse No. 9, road west near	40 11 26.2	83 14 32.3
Watkins, cross road in east part of	40 12 45.5	83 14 41.0
Road east, west, and north	40 13 58.0	83 14 46.1
Road north, south, east, and west	40 15 02.0	83 14 54.5
Road north, south, east, and west	40 16 56.0	83 15 02.0
Road north, west, and south	40 18 00.7	83 15 07.2
Delaware and Union counties, stone monument between	40 20 01.0	83 14 59.6
Roads east, west, and north	40 21 02.9	83 14 19.2
Roads east, west, and north, near schoolhouse	40 21 53.5	83 13 51.0
Road north, east, and south	40 22 54.5	83 14 58.9
State road, northeast and southwest	40 23 46.7	83 16 07.9
Hoskins and State road crossing	40 25 08.6	83 14 57.0
Richwood and Prospect pike	40 26 10.7	83 15 32.1
East and west pike	40 27 47.0	83 15 04.0
Woodland, 570 feet southwest of, crossing Big Four Railway	40 28 45.3	83 15 27.4
Pike crossing, east and west	40 29 37.0	83 15 35.6
Road crossing, east and west	40 30 46.4	83 15 22.2
Road east, north and south	40 31 47.2	83 15 56.0
Do	40 33 04.0	83 16 01.8

Geographic positions along highways from Mount Sterling to McCutchenville—Continued.

Station.	Latitude.	Longitude.
Road, northwest and southeast.....	40 33 20.3	83 15 20.0
Gurley, 1 mile east of, Big Four Railway crossing.....	40 35 09.5	83 15 21.2
Espyville, road crossing southeast and west at.....	40 35 52.5	83 15 20.4
T. 5 S., R. 14 E., $\frac{1}{4}$ corner between secs. 15 and 16.....	40 36 28.8	83 14 47.0
T. 5 S., R. 14 E., corner secs. 3, 4, 9, and 10.....	40 37 47.1	83 14 46.1
Ts. 4 and 5 S., R. 14 E., $\frac{1}{4}$ corner between secs. 3 and 34.....	40 38 39.3	83 14 11.1
Pike road crossing, northeast and southwest.....	40 38 54.7	83 13 13.4
School house, road crossing east and west, near.....	40 40 28.9	83 13 55.7
Crossing, east and west road with Harpster and Marion road.....	40 42 08.4	83 14 53.1
Roads, northeast and southwest.....	40 46 28.5	83 14 28.6
Quarter corner sections (no number).....	40 47 21.6	83 13 03.3
T. 3 S., R. 14 E., corner secs. 2, 3, 10, and 11.....	40 48 13.8	83 13 38.9
Ts. 2 and 3 S., R. 14 E., corner secs. 3, 4, 32, 33.....	40 49 06.2	83 14 47.2
T. 2 S., R. 14 E., $\frac{1}{4}$ corner between secs. 28 and 33.....	40 49 58.4	83 15 22.5
T. 2 S., R. 14 E., $\frac{1}{4}$ corner between secs. 16 and 21.....	40 51 42.9	83 15 23.2
Roads east, west, north, and south.....	40 52 35.4	83 15 04.2
Roads east, west, and northeast.....	40 54 02.0	83 14 47.4
Roads north, west, and south.....	40 54 32.3	83 15 24.6
Sandusky River, bridge over.....	40 55 41.8	83 14 44.7
T. 1 S., R. 14 E., corner secs. 15, 16, 21, and 22.....	40 56 57.9	83 14 49.5
T. 1 S., R. 14 E., corner secs. 9, 10, 15, and 16.....	40 57 49.9	83 14 49.8
McCutchenville, crossing main street and Perrysburg road.....	40 59 26.6	83 15 36.6
McCutchenville, north part of, Ohio Central Railway crossing.....	41 00 08.0	83 15 43.1

Geographic positions along highways from near Bettsville to latitude 41° 00', thence west to longitude 83° 45', thence north to Maumee River, thence east to Dowling, Ohio.

Station.	Latitude.	Longitude.
Station 50 on Oak Harbor line.....	41 16 02.6	83 14 06.8
Bettsville crossing, Pennsylvania Railroad at.....	41 14 41.3	83 14 13.2
Crossroads at section corner.....	41 13 58.9	83 14 42.4
T. 3 N., R. 14 E., corner secs. 15, 16, 21, and 22.....	41 12 36.7	83 14 41.0
T. 3 N., R. 14 E., corner secs. 27, 28, 33, and 34.....	41 10 51.7	83 14 46.2
Ts. 2 and 3 N., R. 14 E., corner secs. 3, 4, 33, and 34.....	41 09 59.6	83 14 49.4
T. 2 N., R. 14 E., corner secs. 9, 10, 15, and 16.....	41 08 17.0	83 14 50.6
T. 2 N., R. 14 E., corner secs. 15, 16, 21, and 22.....	41 07 24.4	83 14 50.4

Geographic positions along highways from near Bettsville, etc.—Continued.

Station.	Latitude.	Longitude.
T. 2 N., R. 14 E., corner secs. 27, 28, 33, and 34	41 05 39.5	83 14 51.6
Ts. 1 and 2 N., R. 14 E., corner secs. 3, 4, 33, and 34	41 04 47.5	83 14 51.6
Roads north, south, east, and west	41 02 36.8	83 14 51.0
T. 1 N., R. 14 E., $\frac{1}{2}$ corner between secs. 16 and 21	41 01 44.6	83 15 49.3
T. 1 N., R. 14 E., $\frac{1}{2}$ corner between secs. 28 and 33	41 00 26.3	83 15 49.5
T. 1 N., Rs. 13 and 14 E., $\frac{1}{2}$ corner between secs. 31 and 36	40 59 59.8	83 18 18.6
T. 1 N. and 1 S., R. 13 E., corner secs. 3, 4, 33, and 34	40 59 32.3	83 21 47.1
T. 1 N. and 1 S., Rs. 12 and 13 E., corner secs. 1, 6, 31, and 36	40 59 30.9	83 25 13.9
Road northeast and southwest	40 59 28.1	83 27 29.1
Vanlue, crossing Big Four Railway, in northwest part of	40 58 32.6	83 29 03.4
Schoolhouse, crossroads at	40 58 31.8	83 30 46.2
Roads east, west, and north	40 58 53.9	83 33 53.2
Roads northeast and southwest	40 58 57.4	83 36 47.1
Ts. 1 N. and 1 S., Rs. 10 and 11 E., corner between	40 59 35.5	83 39 02.2
Ts. 1 N. and 1 S., R. 10 E., corner secs. 1, 2, 35, and 36	40 59 35.7	83 40 11.1
Ts. 1 N. and 1 S., R. 10 E., $\frac{1}{2}$ corner between secs. 3 and 34	40 59 36.0	83 41 54.6
Lake Erie and Western Railroad crossing	41 00 45.2	83 41 54.5
T. 1 N., R. 10 E., $\frac{1}{2}$ corner between secs. 15 and 16	41 02 38.5	83 42 29.2
T. 1 N., R. 10 E., $\frac{1}{2}$ corner between secs. 9 and 10	41 03 30.9	83 42 29.4
Cincinnati, Hamilton and Dayton Railway crossing	41 04 59.2	83 43 36.9
T. 2 N., R. 10 E., corner secs. 28, 29, 32, and 33	41 05 42.6	83 43 37.1
T. 2 N., R. 10 E., corner secs. 16, 17, 20, and 21	41 07 26.8	83 43 37.9
Road northeast and southwest	41 09 34.5	83 43 38.3
T. 3 N., R. 10 E., corner secs. 28, 29, 32, and 33	41 10 58.1	83 43 36.9
T. 3 N., R. 10 E., corner secs. 20, 21, 28, and 29	41 11 50.1	83 43 37.8
T. 3 N., R. 10 E., corner secs. 16, 17, 20, and 21	41 12 42.2	83 43 38.1
T. 3 N., R. 10 E., corner secs. 4, 5, 8, and 9	41 14 26.6	83 43 38.5
T. 4 N., R. 10 E., corner secs. 28, 29, 32, and 33	41 16 09.8	83 43 40.0
T. 4 N., R. 10 E., corner secs. 20, 21, 28, and 29	41 17 02.0	83 43 40.3
T. 4 N., R. 10 E., corner secs. 4, 5, 8, and 9	41 19 38.8	83 43 41.4
Ts. 4 and 5 N., R. 10 E., corner secs. 4, 5, 32, and 33	41 20 34.4	83 43 42.3
T. 5 N., R. 10 E., corner secs. 20, 21, 28, and 29	41 22 18.9	83 43 41.8
T. 5 N., R. 10 E., $\frac{1}{2}$ corner between secs. 8 and 17	41 24 08.8	83 44 16.7
Ts. 5 and 6 N., R. 10 E., $\frac{1}{2}$ corner between secs. 5 and 32	41 25 48.2	83 44 16.9
T. 6 N., R. 10 E., $\frac{1}{2}$ corner between secs. 29 and 32	41 26 40.1	83 44 17.8

Geographic positions along highways from near Bettsville, etc.—Continued.

Station.	Latitude.	Longitude.
T. 6 N., R. 10 E., $\frac{1}{4}$ corner between secs. 17 and 20	41 28 25.2	83 44 17.9
T. 6 N., R. 10 E., corner secs. 14, 15, 26, and 27	41 28 24.0	83 41 23.3
T. 6 N., R. 10 E., corner secs. 13, 14, 23, and 24	41 28 23.9	83 40 13.8

Geographic positions along highways from Vanlue to Pfeiffer, thence west to 83° 45', thence north to southwest corner of Findlay quadrangle.

Station.	Latitude.	Longitude.
Vanlue, Big Four Railway crossing in northwest part of	40 58 32.6	83 29 03.5
T. 1 S., R. 12 E., $\frac{1}{4}$ corner between secs. 16 and 21	40 56 53.5	83 29 10.5
T. 1 S., R. 12 E., $\frac{1}{4}$ corner between secs. 28 and 33	40 55 09.2	83 29 10.3
T. 2 S., R. 12 E., $\frac{1}{4}$ corner between secs. 4 and 9	40 53 24.7	83 29 10.7
Roads northeast and southwest	40 51 51.5	83 29 30.6
$\frac{1}{4}$ corner secs.	40 50 49.0	83 30 23.2
Big Four Railway crossing near milepost 70	40 49 06.4	83 30 08.1
Road crossing northeast and southwest	40 47 09.0	83 29 49.4
T. 3 S., R. 12 E., corner secs. 28, 29, 32, and 33	40 44 41.7	83 29 48.7
T. 4 S., R. 12 E., corner secs. 8, 9, 16, and 17	40 42 04.8	83 29 45.7
T. 4 S., R. 12 E., corner secs. 20, 21, 28, and 29	40 40 19.4	83 29 45.1
Ts. 4 and 5 S., R. 12 E., corner secs. 4, 5, 32, and 33	40 38 34.0	83 29 46.3
Roads north, east, and west	40 37 24.1	83 30 57.4
Henpeck schoolhouse, road crossing at	40 38 04.5	83 33 09.0
Corner secs.	40 38 39.2	83 34 34.0
Kenton, 1.5 miles west of, crossing of Big Four Railway	40 38 48.3	83 38 20.6
Kenton, 4.5 miles west of, crossing of Big Four Railway	40 39 30.7	83 40 30.2
Big Four Railway and north and south road crossing	40 40 09.6	83 42 28.9
T. 3 S., R. 10 E., corner secs. 5, 6, 31, and 32	40 43 57.2	83 44 52.6
T. 3 S., R. 10 E., corner secs. 19, 20, 29, and 30	40 45 42.4	83 44 52.2
T. 3 S., R. 10 E., corner secs. 7, 8, 17, and 18	40 47 26.6	83 44 51.7
Ts. 2 and 3 S., R. 10 E., $\frac{1}{4}$ corner between secs. 5 and 32	40 49 08.9	83 44 16.5
T. 2 S., R. 10 E., corner secs. 19, 20, 29, and 30	40 50 53.5	83 44 48.9
T. 2 S., R. 10 E., corner secs. 7, 8, 17, and 18	40 52 38.5	83 44 48.2
Ts. 1 and 2 S., R. 10 E., corner secs. 5, 6, 31, and 32	40 54 25.5	83 44 47.7
T. 1 S., R. 10 E., corner secs. 19, 20, 29, and 30	40 56 10.3	83 44 47.6
T. 1 S., R. 10 E., corner secs. 7, 8, 17, and 18	40 57 55.2	83 44 48.4
T. 1 S., R. 10 E., corner secs. 5, 6, 7, and 8	40 58 47.7	83 44 48.0

Geographic positions along highways from a position near southwest corner of the Findlay quadrangle west to meridian 84° 00', thence north to Ohio-Michigan boundary line, thence west to longitude 84° 15', thence south to Erie Railroad, thence southeast along railroad to Foraker.

Station.	Latitude.	Longitude.
Findlay, about 5 miles southwest of, Lake Erie and Western Railroad crossing.....	40 58 54.1	83 44 47.9
Ts. 1 N. and 1 S., Rs. 9 and 10 E., corner secs. 1, 6, 31, and 36.....	40 59 36.5	83 45 56.3
Ts. 1 N. and 1 S., R. 9 E., corner secs. 3, 4, 33, and 34.....	40 59 35.9	83 49 23.1
Ts. 1 N. and 1 S., R. 9 E., corner secs. 5, 6, 31, and 32.....	40 59 35.4	83 51 41.3
Ts. 1 N. and 1 S., R. 8 E., corner secs. 1, 2, 35, and 36.....	40 59 35.1	83 53 59.1
Ts. 1 N. and 1 S., R. 8 E., corner secs. 3, 4, 33, and 34.....	40 59 34.7	83 56 17.5
Ts. 1 N. and 1 S., R. 8 E., corner secs. 5, 6, 31, and 32.....	40 59 34.0	83 58 36.2
T. 1 N., Rs. 7 and 8 E., corner secs. 7, 18, 13, and 12.....	41 08 02.2	83 59 45.5
T. 2 N., Rs. 7 and 8 E., corner secs. 25, 30, 31, and 36.....	41 05 40.1	83 59 46.5
T. 2 N., Rs. 7 and 8 E., corner secs. 18, 19, 24, and 13.....	41 07 24.8	83 59 47.5
T. 2 N., Rs. 7 and 8 E., corner secs. 1, 6, 7, and 12.....	41 09 09.5	83 59 48.0
T. 3 N., Rs. 7 and 8 E., corner secs. 25, 30, 31, and 36.....	41 10 53.0	83 59 49.0
T. 3 N., Rs. 7 and 8 E., corner secs. 18, 19, 24, and 13.....	41 12 37.6	83 59 50.2
T. 3 N., Rs. 7 and 8 E., corner secs. 1, 6, 7, and 12.....	41 14 22.2	83 59 51.2
Ts. 3 and 4 N., Rs. 7 and 8 E., corner secs. 1, 6, 31, and 36.....	41 15 15.1	83 59 52.1
T. 4 N., Rs. 7 and 8 E., corner secs. 19, 30, 24, and 25.....	41 16 59.4	83 59 54.0
T. 4 N., R. 7 E., corner secs. 7, 18, 13, and 12.....	41 18 44.4	83 59 56.0
Ts. 4 and 5 N., R. 7 E., corner secs. 1, 6, 31, and 36.....	41 20 30.1	83 59 58.2
T. 5 N., Rs. 7 and 8 E., corner secs. 19, 30, 24, and 25.....	41 22 14.9	83 59 57.7
T. 5 N., R. 7 E., corner secs. 7, 18, 13, and 12.....	41 23 59.3	83 59 57.0
Iron bridge over creek southeast, center of.....	41 25 59.1	83 59 56.0
T. 6 N., Rs. 7 and 8 E., corner secs. 19, 30, 24, and 25.....	41 27 26.9	83 59 55.6
T. 6 N., R. 7 E., corner secs. 7, 18, 13, and 12.....	41 29 11.3	83 59 55.2
Ts. 6 and 7 N., R. 7 E., corner between secs. 1 and 36.....	41 30 55.6	84 00 30.1
Ts. 7 and 8 N., Rs. 7 and 8 E., corner secs. 1, 6, 31, and 36.....	41 36 10.1	83 59 54.1
Ts. 9 and 10 S., Rs. 3 and 4 E., corner secs. 1, 6, 31, and 36.....	41 38 30.9	83 59 45.2
T. 9 S., Rs. 3 and 4 E., corner secs. 24, 19, 30, and 25.....	41 40 13.8	83 59 48.6
T. 9 S., R. 3 E., corner secs. 7, 18, 13, and 12.....	41 41 57.2	83 59 52.5
T. 9 S., R. 3 E., corner secs. 1, 6, 7, and 12.....	41 42 49.8	83 59 54.0
T. 9 S., R. 3 E., corner secs. 2, 3, 10, and 11.....	41 42 50.3	84 02 13.2
T. 9 S., R. 3 E., corner secs. 5, 6, 7, and 8.....	41 42 47.3	84 05 43.1
Ohio-Michigan State line.....	41 42 46.4	84 07 10.1

Geographic positions along highways from a position near southwest corner of the Findlay quadrangle, etc.—Continued.

Station.	Latitude.	Longitude.
	° ' "	° ' "
Schoolhouse, road crossing at	41 42 14.7	84 08 37.0
T. 9 S., R. 2 E., corner secs. 3, 4, 9, and 10, on State line	41 42 30.3	84 10 21.9
T. 9 S., R. 2 E., corner secs. 8, 9, 16, and 17	41 41 48.4	84 11 30.4
T. 9 S., Rs. 1 and 2 E., corner secs. 7, 18, 13, and 12	41 41 47.2	84 13 48.7
T. 9 S., R. 1 E., corner secs. 13, 14, 23, and 24	41 40 54.3	84 14 55.6
T. 9 S., R. 1 E., corner secs. 25, 26, 35, and 36	41 39 08.9	84 14 54.3
T. 10 S., R. 1 E., corner secs. 1, 2, 11, and 12	41 37 24.0	84 14 52.0
T. 7 N., R. 5 E., corner secs. 1, 2, 11, and 12	41 35 12.2	84 14 56.0
T. 7 N., R. 5 E., corner secs. 13, 14, 23, and 24	41 33 27.7	84 14 55.5
T. 6 N., R. 5 E., corner secs. 1, 2, 11, and 12	41 30 00.5	84 14 53.6
T. 6 N., R. 5 E., corner secs. 13, 14, 23, and 24	41 28 16.1	84 14 52.8
Ridgeville corners, crossroads at	41 26 15.8	84 15 26.0
T. 5 N., R. 5 E., corner secs. 1, 2, 11, and 12	41 24 46.9	84 14 50.7
T. 5 N., R. 5 E., corner secs. 13, 14, 23, and 24	41 23 02.3	84 14 49.3
T. 5 N., R. 5 E., corner secs. 25, 26, 35, and 36	41 21 17.6	84 14 48.0
T. 4 N., R. 5 E., corner secs. 1, 2, 11, and 12	41 19 32.5	84 14 48.0
T. 4 N., R. 5 E., corner secs. 13, 14, 23, and 24	41 17 48.2	84 14 48.0
T. 4 N., R. 5 E., corner secs. 25, 26, 35, and 36	41 16 03.8	84 14 47.9
Ts. 3 and 4 N., R. 5 E., corner secs. 1, 2, 35, and 36	41 15 11.5	84 14 47.8
T. 3 N., R. 5 E., corner secs. 11, 12, 13, and 14	41 13 26.1	84 14 48.6
T. 3 N., R. 5 E., corner secs. 23, 24, 25, and 26	41 11 41.7	84 14 49.8
Ts. 2 and 3 N., R. 5 E., corner secs. 1, 2, 35, and 36	41 09 57.3	84 14 50.2
T. 2 N., R. 5 E., corner secs. 11, 12, 13, and 14	41 08 13.0	84 14 49.7
T. 2 N., R. 5 E., corner secs. 23, 24, 25, and 26	41 06 28.1	84 14 48.4
Ts. 1 and 2 N., R. 5 E., corner secs. 1, 2, 35, and 36	41 04 43.4	84 14 47.2
T. 1 N., Rs. 5 and 6 E., corner secs. 1, 6, 7, and 12	41 03 52.0	84 13 37.7
T. 1 N., Rs. 5 and 6 E., corner secs. 25, 30, 31, and 36	41 00 22.3	84 13 35.9
T. 1 S., Rs. 5 and 6 E., corner secs. 1, 6, 7, and 12	40 58 37.0	84 13 34.3
T. 1 S., R. 5 E., corner secs. 11, 12, 13, and 14	40 57 42.6	84 14 39.7
T. 1 S., R. 5 E., corner secs. 23, 24, 25, and 26	40 55 58.8	84 14 39.5
Ts. 1 and 2 S., R. 5 E., corner secs. 1, 2, 35, and 36	40 54 14.5	84 14 38.1
T. 2 S., R. 5 E., corner secs. 13, 14, 23, and 24	40 51 35.6	84 14 37.5
T. 2 S., R. 5 E., corner secs. 25, 26, 35, and 36	40 49 51.9	84 14 37.2
T. 3 S., R. 5 E., corner secs. 1, 2, 11, and 12	40 48 07.8	84 14 36.3
T. 3 S., R. 5 E., corner secs. 13, 14, 23, and 24	40 46 23.6	84 14 35.0
T. 3 S., R. 5 E., corner secs. 25, 26, 35, 36	40 44 38.5	84 14 33.3
Ts. 3 and 4 S., R. 5 E., corner secs. 1, 2, 35, and 36	40 43 46.1	84 14 32.8

Geographic positions along Erie Railroad from Kemp to Foraker.

Station.	Latitude.	Longitude.
	° ' "	° ' "
Kemp station (Kempton post-office).....	40 48 25.6	84 18 27.6
Road crossing, northeast and southwest.....	40 48 33.9	84 09 19.0
Lima station.....	40 48 26.4	84 06 21.9
Ohio Southern Railroad crossing.....	40 48 26.5	84 05 10.5
T. 4 S., R. 7 E., corner secs. 3, 4, 9, and 10.....	40 48 00.7	84 03 06.3
T. 4 S., Rs. 7 and 8 E., corner secs. 1, 6, 7, and 12	40 42 59.7	83 59 38.7
Westminster station.....	40 42 57.2	83 59 35.3
Harrod station.....	40 42 33.9	83 55 15.9
Algiers station.....	40 42 19.1	83 50 37.6
T. 4 S., R. 9 E., corner secs. 8, 7, 16, and 17.....	40 42 14.1	83 50 31.5
McGuffey station.....	40 41 40.1	83 47 05.3
Foraker station.....	40 40 46.6	83 44 21.8

Geographic positions for control of Westerville quadrangle.

Station.	Latitude.	Longitude.
	° ' "	° ' "
Columbus, Mock road crossing.....	40 00 54.0	82 59 47.9
Road northeast and southwest (electric railway)	40 00 49.5	82 58 03.2
Cleveland, Akron and Columbus Railway crossing (azimuth of railway 194° 08').....	40 00 49.1	82 57 54.3
Road north and south.....	40 00 47.7	82 57 24.1
Alum Creek, south end of bridge.....	40 00 34.7	82 56 06.5
Road north and south.....	40 01 13.3	82 54 41.5
Road north and south.....	40 01 08.7	82 53 03.1
Gehanna, center of bridge over Big Walnut River.....	40 01 08.3	82 52 48.7
T. 1, Rs. 16 and 17, secs. 1, 2, 3, 4, corner of road north and south.....	40 01 06.2	82 52 00.1
District No. 11, schoolhouse.....	40 01 02.9	82 50 39.4
T. 1, R. 16, corner secs. 2, 1, 4, 3.....	40 00 57.6	82 49 08.0
Havens Corners, crossroads.....	40 01 10.4	82 48 54.3
Road north and south, at schoolhouse.....	40 01 09.6	82 47 23.4
Franklin-Licking county line, road north.....	40 01 06.0	82 46 18.4
Squire Swishers, road north and south.....	40 00 56.6	82 45 00.6
Road east and west.....	40 02 33.8	82 44 51.9
Road east and west.....	40 03 07.4	82 44 51.1
Intersection, road north and road east and west, south of schoolhouse.....	40 03 02.0	82 45 20.8
Bridge.....	40 03 40.2	82 45 18.0
Beech, crossroads.....	40 04 46.2	82 45 13.3
Road east and west.....	40 05 50.6	82 45 14.6

Geographic positions for control of Westerville quadrangle—Continued.

Station.	Latitude.	Longitude.
	° ' "	° ' "
Bridge over branch running west	40 06 34.0	82 45 11.6
Intersection of road north and Johnstown road northeast and southwest	40 07 27.6	82 45 07.5
Licking, Franklin, and Delaware counties, corner of; also corner Ts. 2 and 3, Rs. 15 and 16, secs. 2, 3, 4, 1	40 07 33.8	82 45 43.0
Road west at schoolhouse	40 08 19.9	82 45 39.6
Road east and west and southeast	40 09 22.6	82 45 34.8
Road east	40 10 17.9	82 45 30.8
Road north near Clem Blamer's house	40 10 14.4	82 44 18.6
Road northwest and southeast	40 10 45.2	82 44 16.2
Road east and west	40 12 27.1	82 44 24.4
Wm. Feasels, crossroads	40 13 56.8	82 44 17.7
Delaware-Licking county line, road north and south	40 13 59.0	82 45 15.3
Road north	40 13 57.7	82 47 24.1
South Condit, crossroads	40 14 52.9	82 47 20.4
Road north	40 14 44.8	82 49 48.5
Cleveland, Akron and Columbus crossing (azimuth of railway 253° 00')	40 14 47.4	82 50 42.3
Big Walnut Creek, center of bridge	40 14 48.6	82 50 59.3
Sunbury, Harrison street and Mount Vernon road, at Dr. Vankirk's	40 14 42.3	82 51 14.5
Road northwest and southeast	40 14 44.4	82 51 53.6
Road west to Rome	40 15 01.5	82 52 18.6
T. 4, R. 17, secs. 1, 2, 3, 4, corner of	40 14 46.2	82 53 40.0
Rome, intersection of roads at guidepost	40 14 48.1	82 54 38.7
Johnny Cake schoolhouse, road north and south	40 14 17.0	82 56 22.7
Cheshire, road north	40 14 19.9	82 57 41.0
Cheshire, Whitman's store	40 14 20.1	82 57 45.8
Cheshire, 1 mile west of, station on Green Spring and Columbus line	40 14 22.4	82 58 45.8
District No. 7, schoolhouse, road south	40 14 24.9	83 00 22.7
Big Four Railway crossing (azimuth 176° 56')	40 14 26.0	83 00 46.2
Columbus-Delaware road	40 14 31.9	83 03 05.7
Intersection of roads north and south and west (about 800 feet below bridge over Olentangy River)	40 15 10.4	83 03 46.7
T. 4, R. 19, secs. 1, 2, 3, 4, corner of, road north and south	40 15 12.1	83 04 56.4
Hocking Valley Railway road crossing, 340 feet south of milepost 103	40 15 12.6	83 05 08.5

Geographic positions for control of Mount Sterling quadrangle.

Station.	Latitude.	Longitude.
	° ' "	° ' "
Mount Sterling, Main street crossing Baltimore and Ohio Railroad (Hawkins traverse, 1900)	39 43 17.6	83 16 03.7
Mount Sterling, road southwest to Washington Court-House	39 42 59.3	83 16 06.2
Fayette-Madison county line	39 41 47.3	83 16 16.4
Jones schoolhouse No. 5, center of road	39 40 51.0	83 16 16.6
Old Yankeetown, east and west road	39 39 41.1	83 16 05.8
Schoolhouse No. 2, road	39 38 50.6	83 16 16.3
Waterloo, in front of Methodist Church	39 37 24.7	83 15 55.5
Fayette-Pickaway county line, stone monument	39 37 01.4	83 15 31.0
Road north and south	39 36 09.4	83 16 04.9
Bridge near Chauncey Dicks	39 35 29.9	83 15 56.0
Pike, northwest and southeast	39 34 08.0	83 16 13.5
Pickaway and Fayette counties, road on line of	39 33 32.8	83 15 46.9
New Holland, Main street crossing Cincinnati and Muskingum Valley Railroad	39 33 15.8	83 15 26.2
Road southwest	39 31 31.2	83 14 43.9
Ross-Pickaway county line	39 30 55.6	83 14 56.7
Schoolhouse No. 9, intersection of roads	39 30 15.2	83 15 03.4
Brick schoolhouse, District No. 10, crossroads	39 28 53.5	83 14 45.9
Plano post-office	39 29 27.2	83 17 07.2
Fairview, road crossing Cincinnati, Hamilton and Dayton Railway (azimuth 282° 58')	39 28 48.5	83 18 15.6
Fairview church, road north	39 28 42.1	83 19 19.8
Road north and south	39 28 49.6	83 20 14.1
Pleasant Grove, southwest corner schoolhouse yard, road north	39 30 02.2	83 21 36.6
Blacksmith shop, road north and south	39 30 32.8	83 22 39.8
Bridge over drain south	39 30 50.6	83 23 57.1
Washington Court-House, north end of bridge over Middle Fork Paint Creek, 1 mile south of	39 31 04.4	83 25 01.5
Ohio Southern Railway crossing near trestle, 480 feet southeast of milepost 102	39 30 55.1	83 25 06.5
Washington Court-House, crossroads on Greenfield pike, 2 miles south of	39 30 34.2	83 26 28.8
Leesburg pike, north and south	39 30 16.3	83 28 22.3
Snow Hill pike, Ingles schoolhouse, 20 feet north	39 30 19.6	83 29 43.1
Jasper Mills, Baltimore and Ohio Railroad crossing, $\frac{1}{4}$ mile east of (azimuth 253° 36')	39 31 19.1	83 30 27.0
Sugar Creek church, intersection of Palmer pike, east and west and road north, about 300 feet west of	39 32 54.1	83 30 27.5
Johnstown schoolhouse	39 33 59.5	83 30 19.6
Township line, stone post	39 34 26.5	83 30 46.4

Geographic positions for control of Mount Sterling quadrangle—Continued.

Station.	Latitude.	Longitude.
Luray siding Cincinnati, Hamilton and Dayton Railway, east switch block	39 34 36.3	83 30 51.6
Hagler, Ohio Southern Railroad crossing	39 35 16.8	83 30 55.7
Washington-Jefferson pike, northwest and southeast	39 35 41.1	83 30 46.2
Blackoak schoolhouse, platform in front of	39 36 08.6	83 30 29.8
Paint Creek, west end of bridge over	39 37 10.1	83 29 17.2
McDill's blacksmith shop, road east and west	39 38 58.3	83 30 01.1
Paint Creek, center of bridge over	39 39 35.3	83 30 16.7
Paint Creek, south end of iron bridge over	39 39 49.9	83 30 17.2
Pike, west, at small bridge	39 40 31.3	83 30 15.7
Maple Grove schoolhouse	39 41 47.6	83 30 15.2
Fayette-Madison County, stone monument	39 42 29.9	83 30 10.1
Hayes schoolhouse, road east and west	39 42 51.4	83 29 52.4
Sedalia, Ohio Southern Railroad crossing, $\frac{1}{4}$ mile southwest of	39 43 28.7	83 29 17.4
Sedalia, South Solon pike, east and west	39 44 01.4	83 29 06.5
Sedalia, intersection Main street and road east and west	39 44 00.5	83 28 36.7
Bridge over creek northeast	39 43 55.9	83 25 45.2
Range, London pike northwest	39 43 55.5	83 25 31.7
Bethel, M. E. Church, crossroads at	39 43 48.8	83 23 37.4
Bridge over branch south	39 43 52.0	83 22 16.6
Chenowith, road north	39 43 51.6	83 21 25.1
Sugar Run bridge	39 43 49.7	83 19 53.9
Road south at schoolhouse	39 43 48.8	83 19 11.5
Mount Sterling, London pike, $\frac{1}{2}$ mile north of	39 43 48.7	83 16 17.2
Stokes-Range township monument	39 44 02.8	83 30 07.8
Sedalia, 2 miles west of, center of South Solon pike, in front of Jim Chapman's gate	39 43 59.8	83 31 02.3

Geographic positions between Green Spring and Columbus, along or near the eighty-third meridian.

Station.	Latitude.	Longitude.
T. 3 N., R. 16 E., corner secs. 3, 2, 11, and 10	41 14 29.4	82 59 40.2
T. 3 N., R. 16 E., corner secs. 10, 11, 14, and 15, road east and west	41 13 37.0	82 59 40.6
T. 3 N., R. 16 E., corner secs. 15, 14, 23, and 22, road east and west	41 12 44.7	82 59 41.4
T. 3 N., R. 16 E., corner secs. 22, 23, 26, and 27, road east and west, schoolhouse	41 11 51.4	82 59 42.2

Geographic positions between Green Spring and Columbus, etc.—Continued.

Station.	Latitude.	Longitude.
T. 3 N., R. 16 E., corner secs. 27, 28, 35, and 34, road east and west	41 10 59.4	82 59 43.4
Ts. 2 and 3 N., R. 16 E., corner secs. 34, 35, 2, and 3, road east and west (jogs east 50 feet, then turns south)	41 10 08.1	82 59 46.4
T. 2 N., R. 16 E., corner secs. 3, 2, 11, and 10	41 09 12.8	82 59 44.9
T. 2 N., R. 16 E., corner secs. 10, 11, 14, and 15	41 08 20.4	82 59 45.5
T. 2 N., R. 16 E., corner secs. 15, 14, 23, and 22, road east and west	41 07 28.2	82 59 45.6
T. 2 N., R. 16 E., corner secs. 27, 28, 35, and 34, road east and west	41 05 43.5	82 59 45.6
Ts. 1 and 2 N., R. 16 E., corner secs. 34, 35, 2, and 3, road east and west	41 04 51.3	82 59 45.6
T. 1 N., R. 16 E., corner secs. 3, 2, 11, and 10, road east	41 03 57.9	82 59 45.9
T. 1 N., R. 16 E., corner secs. 10, 11, 14, and 15, pike east	41 03 05.5	82 59 46.5
Bloomville, Pennsylvania Railroad crossing, 290 feet east of switch block (azimuth of railway 308° 55')	41 02 40.8	82 59 56.6
T. 1 N., R. 16 E., corner secs. 15, 14, 23, and 22, roads east and west and northwest	41 02 13.3	82 59 46.8
T. 1 N., R. 16 E., corner secs. 22, 23, 26, and 27, road east and west	41 01 21.1	82 59 48.2
T. 1 N., R. 16 E., corner secs. 27, 26, 35, and 34, road east and west	41 00 28.9	82 59 47.8
Ts. 1 N. and 1 S., R. 16 E., corner secs. 34, 35, 2, and 3, road east and west	40 59 36.2	82 59 49.6
T. 1 S., R. 16 E., corner secs. 3, 2, 11, and 10, road east and west	40 58 45.3	82 59 49.7
T. 1 S., R. 16 E., corner secs. 10, 11, 14, and 15, road east and west	40 57 52.9	82 59 49.7
Northern Ohio Railway and road crossing (azimuth west 89° 50')	40 57 26.5	82 59 49.9
T. 1 S., R. 16 E., corner secs. 14, 15, 23, and 22, road east and west	40 57 00.2	82 59 49.9
T. 1 S., R. 16 E., corner secs. 22, 23, 26, and 27, road east and west	40 56 07.9	82 59 50.0
T. 1 S., R. 16 E., corner secs. 27, 26, 35, and 34, road east and west	40 55 15.5	82 59 50.4
Ts. 1 and 2 S., R. 16 E., corner secs. 34, 35, 2, and 3, road east and west	40 54 23.4	82 59 50.8
Broken Sword, cross roads at Ts. 1 and 2 S., R. 16 E., corner secs. 33, 34, 3, 4	40 54 23.3	83 00 59.4
T. 2 S., R. 16 E., corner secs. 3, 4, 10, and 9, road east and west	40 53 30.4	83 00 59.9
T. 2 S., R. 16 E., corner secs. 9, 10, 15, and 16, road east and west	40 52 38.2	83 00 59.9

Geographic positions between Green Spring and Columbus, etc.—Continued.

Station.	Latitude.	Longitude.
T. 2 S., R. 16 E., corner secs. 16, 15, 22, and 21, road east and west, schoolhouse	40 51 46.1	83 00 59.8
Ohio Central Railway, at road crossing (azimuth $120^{\circ} 32'$)	40 50 49.8	83 00 59.5
Ts. 2 and 3 S., R. 16 E., corner secs. 33, 34, 3, and 4	40 49 08.5	83 00 59.4
Bucyrus; Pennsylvania Railroad crossing, 2 miles west of (azimuth $273^{\circ} 52'$)	40 48 41.4	83 01 03.2
T. 3 S., R. 16 E., corner secs. 4, 3, 10, and 9, road east and west	40 48 16.3	83 01 02.5
Northeast and southwest pike road and road south	40 47 38.8	82 59 53.4
Marion City, road northeast and southwest	40 46 38.5	82 59 52.7
Columbus, Sandusky & Hocking Railroad crossing (azimuth $34^{\circ} 22'$)	40 46 31.7	82 59 14.9
Road east and west	40 44 47.4	82 59 29.9
Ts. 3 and 4 S., R. 16 E., corner secs. 34, 35, 2, and 3, road west	40 43 55.0	82 59 42.5
Road east and west	40 43 08.9	82 59 59.4
Crawford and Marion county line, road east and west	40 42 11.1	83 00 15.6
Kirkpatrick, road east and west	40 41 18.9	83 00 30.7
T. 4 S., R. 16 E., corner secs. 21, 22, 28, and 27, road east and west	40 40 26.3	83 00 53.0
Road east and west	40 39 07.4	83 01 08.7
Erie Railroad crossing (azimuth $248^{\circ} 04'$)	40 37 05.3	83 01 44.8
T. 5 S., R. 16 E., $\frac{1}{4}$ corner between secs. 15 and 10	40 36 56.8	83 00 18.4
T. 5 S., R. 16 E., corner secs. 15, 14, 23, and 22	40 36 04.6	82 59 44.1
T. 5 S., R. 16 E., corner secs. 22, 23, 26, and 27, road northeast, due east of	40 35 12.2	82 59 48.5
Road east and west	40 33 43.1	82 59 44.9
T. 6 S., R. 16 E., corner secs. 3, 2, 11, and 10	40 32 34.0	82 59 44.1
T. 6 S., R. 16 E., corner secs. 10, 11, 14, and 15, road east and west	40 31 42.0	82 59 44.2
T. 6 S., R. 16 E., corner secs. 15, 14, 23, and 22, road east and west	49 30 48.9	82 59 43.8
T. 6 S., R. 16 E., corner secs. 22, 23, 26, and 27, road east and west (church)	40 29 56.0	82 59 44.2
Road east and west	40 29 29.7	82 59 44.6
Marion Morrow, county line	40 29 08.1	83 00 25.9
Corner lots 15, 14, 20, and 21, road east and west	40 28 20.1	83 00 27.9
T. 7 N., R. 18 W., corner lots 21, 22, 20, and 19, crossroads	40 27 21.6	83 00 32.0
T. 7 N., R. 18 W., corner lots 12, 9, 8, and 13, road north and south	40 27 18.2	82 59 21.7
Westfield, $\frac{1}{4}$ mile west of, center of bridge over Whetstone River	40 25 56.8	82 59 13.2

Geographic positions between Green Spring and Columbus, etc.—Continued.

Station.	Latitude.	Longitude.
T. 6 N., R. 18 W. corner lots 13, 8, 7, and 14, pike east and west, schoolhouse	40 24 43.0	83 00 04.2
Crossroads corner lots 15 (turn east)	40 23 49.9	83 00 10.6
Schoolhouse (turn south)	40 23 48.8	82 59 40.7
Leonardsburg, 840 feet northeast of Big Four station	40 21 34.5	82 59 14.5
Leonardsburg, 1 mile southwest of, road crossing	40 20 39.4	82 59 50.3
Road northeast and southwest	40 19 58.3	82 59 53.5
Corner lots 19, 12, 11, and 20	40 19 58.7	82 59 53.5
Big Four Railway crossing	40 19 53.6	83 00 33.0
T. 5 N., R. 18 W., sec. 3, lots 22 and 23, (Edin-Delaware Pike northeast and southwest)	40 18 32.7	83 00 37.8
Pike east and west, where old railroad crosses	40 17 46.6	83 00 59.2
On pike running southeast and northwest, road south	40 17 17.7	83 00 57.2
Road east and west	40 16 08.1	83 00 02.2
Road west to Berlin station	40 15 16.6	82 59 35.1
T. 4 N., R. 18 W., secs. 2, 1, 4, 3	40 14 58.2	82 59 11.9
Cheshire, 1 mile west of, State road north and south	40 14 22.4	82 58 45.9
Road east and west	40 12 59.2	82 59 04.8
Road east and west	40 11 54.2	82 59 24.0
T. 3 N., R. 18 W., corner secs 2, 1, 4, 3	40 10 26.2	82 59 31.8
Road east and west	40 09 26.0	82 59 42.3
Road east	40 08 44.7	82 59 58.4
Delaware-Franklin county line, road east	40 08 10.2	83 00 16.4
Crossing under Big Four Railway, turn south on railway	40 08 07.6	83 00 19.0
Flint, road crossing 210 feet north of station	40 07 38.3	83 00 16.9
Road crossing	40 06 33.3	83 00 12.3
Worthington, 4 mile south of, junction Columbus, Sandusky and Hocking Valley and Big Four railways	40 05 10.9	83 00 06.4
Road crossing	40 03 42.0	83 00 00.0
Road crossing	40 01 58.6	82 59 52.6
Mock road crossing, east and west	40 00 54.1	82 59 47.9
Columbus, intersection North Fourth street and Wyandotte avenue	40 00 36.3	82 59 53.4
Columbus, intersection North High street and West Lane avenue	40 00 21.9	83 00 33.8

Geographic positions along highways from Oak Harbor west to about meridian $83^{\circ} 15'$, thence south following near said meridian to about parallel $41^{\circ} 15'$ thence east following near said parallel to a point nearly south of the United States Lake Survey triangulation station Townsend.

Station.	Latitude.	Longitude.
Oak Harbor station, 700 feet east of, crossing north and south.....	41 31 11.8	83 08 44.4
T. 6 N., R. 14 E., corner secs. 15, 16, 21, and 22, road east and west.....	21 00 00.0 41 28 21.1	83 14 28.4
Road east and west.....	41 27 54.9	83 14 28.0
Road east.....	41 26 37.0	83 14 26.5
Lake Shore Railway (azimuth $314^{\circ} 41' 20''$)	41 25 58.1	83 14 25.8
T. 5 N., R. 14 E., corner secs. 3, 4, 9, and 10, road east.....	41 24 49.5	83 14 26.4
Hessville, crossing electric railway in southeast part.....	41 24 03.5	83 14 32.6
Road east and west.....	41 22 13.4	83 13 23.8
T. 5 N., R. 14 E., corner secs. 26, 27, 34, and 35, road east and west.....	41 21 21.2	83 13 25.7
Ts. 4 and 5 N., R. 14 E., corner secs. 2, 3, 34, and 35.....	40 20 29.1	83 13 27.9
Corner secs. 2, 3, 10, and 11, road east and west.....	41 19 33.0	83 13 32.7
Road east and west.....	41 16 55.3	83 14 07.6
Lake Erie and Western Railroad (azimuth $48^{\circ} 50'$)	41 16 37.3	83 14 07.3
Roads north, east, south, and west.....	41 16 02.6	83 14 06.8
Road southwest	41 16 05.6	83 12 21.8
Road northeast.....	41 16 17.2	83 12 08.6
Road north, south, east, and west.....	41 15 43.4	83 11 16.4
Road north and south.....	41 15 45.1	83 10 04.8
T. 4 N., R. 15 E., center section 33.....	41 15 47.7	83 08 26.4
T. 4 N., R. 15 E., $\frac{1}{4}$ corner between secs. 33 and 34.....	41 15 48.7	83 07 52.5
Ts. 3 and 4 N., R. 15 E., corner secs. 3, 4, 33, and 34.....	41 15 22.1	83 07 53.9
Ts. 3 and 4 N., R. 15 E., corner secs. 2, 3, 34, and 35, road north.....	41 15 22.9	83 06 44.3
Ts. 3 and 4 N., R. 15 E., corner secs. 1, 2, 35, and 36, road north and south.....	41 15 23.5	83 05 31.4
Ts. 3 and 4 N., Rs. 15 and 16 E., corner secs. 1, 6, 31, and 36, road north.....	41 15 23.7	83 04 21.9
Ts. 3 and 4 N., R. 16 E., corner secs. 5, 6, 31, and 32.....	41 15 23.8	83 03 15.6
Green Spring, crossing main street.....	41 15 23.2	83 03 07.4
Big Four Railway crossing (azimuth $227^{\circ} 28'$)	41 15 22.8	83 02 52.5
Ts. 3 and 4 N., R. 16 E., corner secs. 3, 4, 33, and 34.....	41 15 20.2	83 00 49.1
New York, Chicago and St. Louis Railroad crossing.....	41 15 20.1	83 00 46.8
Ts. 3 and 4 N., R. 16 E., corner secs. 2, 3, 34, and 35, road south	41 15 20.2	82 59 39.5

Geographic positions along highways from Oak Harbor, etc.—Continued.

Station.	Latitude.	Longitude.
Ts. 3 and 4 N., R. 16 E., corner secs. 1, 2, 35, and 36, road north and south	° ' " 41 15 20.4	° ' " 82 58 30.6
Ts. 3 and 4 N., Rs. 16 and 17 E., corner secs. 1, 6, 31, and 36, road north and south	41 15 20.2	82 57 21.1
Ts. 3 and 4 N., R. 17 E., corner secs. 5, 6, 31, and 32, road north and south	41 15 20.0	82 56 11.4
Ts. 3 and 4 N., R. 17 E., corner secs. 4, 5, 32, and 34, road north and south	41 15 19.6	82 55 02.1
Ts. 3 and 4 N., R. 17 E., corner secs. 3, 4, 33, and 34, road north and south	41 15 19.2	82 52 52.2
Road northeast and southwest	41 15 18.7	82 52 19.1
Road north and south	41 15 18.5	82 51 32.5
Hocking Valley Railway (azimuth 207° 25')	41 15 18.3	82 50 48.6
Road north and south	41 14 49.8	82 48 09.2
Lake Shore Railway (azimuth 307° 31')	41 15 34.5	82 46 58.4
Road north and south	41 15 34.6	82 45 50.9
Road northwest	41 15 21.8	82 44 43.4
Monroeville, north part of, Baltimore and Ohio Railroad crossing	41 15 02.5	82 41 52.2
Road northeast and southwest	41 15 00.8	82 41 04.0
Road north and south	41 14 59.5	82 39 55.2
Norwalk, corner Whittsey and Washington streets	41 14 58.7	82 37 12.6
Norwalk, junction Lake Erie and Lake Shore rail-ways	41 14 52.4	82 36 09.6
T. 3 N., R. 22 E., corner secs. 1, 2, 3, and 4	41 14 58.9	82 35 25.8
Road north and south	41 14 58.0	82 33 57.6
Road north and south	41 14 56.7	82 31 58.0
Road north and south	41 14 53.5	82 29 30.8
Townsend, United States Lake Survey triangula-tion station	41 15 43.5	82 29 00.6

Geographic positions from Townsend triangulation station eastward along or near parallel 41° 15' to meridian 82° 15', thence northward to Brownhelm triangulation station of the United States Lake Survey.

Station.	Latitude.	Longitude.
Road north and south	41 14 51.6	82 28 01.8
T. 4 N., Rs. 20 and 21 W., corner secs. 1, 2, 3, and 4	41 14 50.7	82 26 32.6
Wakeman, road north through center of	41 14 51.0	82 24 08.4
T. 4 N., R. 20 W., corner secs. 1, 2, 3, and 4	41 14 51.5	82 23 31.1
Road north and south	41 14 16.8	82 21 40.8
Road north	41 14 16.5	82 20 50.5
Road north	41 14 15.7	82 19 56.3
T. 4, R. 19, lots 29, 28, 4, and 5, corner between sub-districts 3 and 4	41 14 15.3	82 18 16.2
Road north and south	41 14 15.3	82 17 22.8
T. 4 N., Rs. 18 and 19, corner between subdistricts 3 and 4	41 14 14.7	82 16 06.9
Road north and south	41 14 14.1	82 15 23.1
T. 4, R. 18, T. lots 75, 76, 85, and 86, Center Pittsfield	41 14 18.4	82 13 07.1
Crossing electric railway, run north on railway	41 14 18.4	82 13 06.8
Road east and west	41 15 55.6	82 13 03.0
Crossing Lake Shore Railway	41 16 53.1	82 14 12.6
Road east and west	41 17 40.6	82 14 19.0
T. 5, R. 18, corner lots 53, 54, 63, and 64, road east	41 18 32.3	82 14 17.1
South Amherst, cross roads at	41 21 27.2	82 14 26.0
Crossing Lake Shore at stone quarry No. 6	41 22 09.7	82 15 11.0
Crossing Lake Shore at stone quarry No. 6	41 22 14.1	82 15 10.9
Cross roads	41 22 42.8	82 15 10.6
Shore Rice, in front of machine shop	41 22 46.3	82 15 26.9
T. 6, R. 19, corner lots 38, 39, 42, and 43, Brownhelm post-office	41 23 20.9	82 16 58.1
Brownhelm, United States Lake Survey triangulation station	41 23 18.5	82 18 28.8

ALABAMA.

PRIMARY TRAVERSE.

The following geographic positions were determined from primary traverse in 1901 by Mr. George T. Hawkins, topographer. The line starts from United States Coast and Geodetic Survey triangulation station Kahatchee and follows the Central of Georgia Railway to Opelika, thence by the Western Railway of Alabama to Montgomery and connected with the capitol dome.

Geographic positions along Central of Georgia Railway.

Station.	Latitude.	Longitude.
Zuber, road crossing at	33 18 55.8	86 18 02.0
Sylacauga, crossing of Louisville and Nashville Railroad	33 10 25.0	86 15 01.9
Trammels, road crossing at	33 07 28.7	86 12 05.4
Hollins station	33 07 03.2	86 09 05.3
Parkdale, road crossing at	33 05 52.5	86 06 42.0
Goodwater station	33 03 51.8	86 03 06.0
Milepost 85, road crossing 900 feet north of	33 02 17.7	86 02 06.4
Milepost 84, road crossing 1,400 feet north of	33 01 32.6	86 01 56.8
Milepost 84, road crossing 550 feet south of	33 01 14.2	86 02 03.7
Siding, road crossing 500 feet south of	33 00 32.9	86 02 00.3
Mileposts 82 and 83, road crossing between	33 00 00.2	86 01 58.6
Kellyton station	32 58 48.6	86 01 55.9
Kellyton, road crossing $\frac{1}{2}$ mile southeast of	32 58 29.0	86 01 33.8
Kellyton, road crossing at county line southeast of	32 58 04.3	86 00 18.2
Milepost 78, road crossing 400 feet north of	32 57 31.1	85 59 32.6
Alexander, main street crossing at	32 56 42.1	85 57 12.0
Milepost 71, road crossing $\frac{1}{2}$ mile south of	32 55 12.0	85 54 16.2
Tallapoosa bridge, northeast end of ironwork	32 54 51.6	85 52 48.9
Tallapoosa bridge, southeast end of ironwork	32 54 46.0	85 52 42.9
Sturdevant station	32 54 32.2	85 52 33.3
Jacksons Gap, road crossing at	32 53 13.7	85 48 40.9
Milepost 63, road crossing south of	32 53 07.4	85 47 10.4
Section line, east and west, road crossing on	32 52 41.7	85 46 39.5
Mileposts 61 and 62, road crossing between	32 52 28.9	85 46 26.1
Dadeville, main street crossing	32 50 06.3	85 45 24.3
Siding, road crossing at	32 49 21.2	85 41 39.7
Campbell, road crossing at	32 48 01.6	85 39 10.4
Campbell station	32 47 59.1	85 39 10.6
Ross, road crossing $\frac{1}{2}$ mile southeast of	32 46 35.4	85 38 00.6
Milepost 46, road crossing at	32 45 32.3	85 36 25.3
County line, north and south road crossing at	32 45 32.3	85 35 35.8
Waverly, road crossing at	32 44 08.0	85 34 34.1
Waverly station	32 44 07.8	85 34 33.3
Milepost 41, road crossing near	32 44 00.6	85 32 33.3
Goldhill station	32 43 25.8	85 30 29.2
Milepost 37, road crossing $\frac{1}{2}$ mile southeast of	32 42 22.4	85 28 39.8
Aubrey, road crossing at	32 40 02.4	85 27 14.5

Geographic positions along Western Railway of Alabama.

Station.	Latitude.	Longitude.
Opelika, point on Western Railway of Alabama 15 feet east of water tank.....	32 38 25.5	85 23 23.7
Auburn, road crossing east of.....	32 36 37.1	85 28 48.0
Auburn station.....	32 36 36.3	85 28 51.6
Milepost 55, road crossing $\frac{1}{4}$ mile west of	32 35 58.5	85 32 54.7
Loachapoka station.....	32 36 14.4	85 35 54.6
Mileposts 51 and 52, road crossing between	32 36 15.1	85 36 06.0
Milepost 49, road crossing $\frac{1}{4}$ mile west of	32 35 26.5	85 38 30.6
Notasulga station	32 33 41.9	85 40 11.1
Milepost 41, road crossing 550 feet southwest of.....	32 29 34.6	85 41 47.0
Chehaw station.....	32 28 52.8	85 42 50.9
Clough, road crossing at	32 28 58.4	85 45 48.9
Franklin, road crossing at	32 28 42.9	85 47 58.6
Franklin station	32 28 41.3	85 48 10.9
Cowles station.....	32 27 52.4	85 51 56.6
Cowles, crossing at	32 27 50.1	85 51 59.2
Milstead station	32 26 34.1	85 53 50.5
Milepost 27, crossing near.....	32 26 26.0	85 54 33.2
Shorter station	32 24 55.0	85 58 00.6
Clietts station	32 24 07.0	85 59 52.0
Mount Meigs station.....	32 23 55.4	86 06 28.6
Milepost 9, road crossing $\frac{1}{4}$ mile east of	32 25 01.3	86 11 17.9
Sevenmile siding, north and south road crossing near west end of	33 25 32.9	86 13 29.4
Mileposts 3 and 4, gravel road crossing between	32 35 28.1	86 17 03.2
Montgomery, capitol dome at	32 22 39.9	86 18 01.8

INDIANA-ILLINOIS.**PRIMARY TRAVERSE.**

The following geographic positions were determined by primary traverse by Mr. George T. Hawkins, topographer, in August, 1901.

The line starts from an adjusted position established by primary traverse in 1899 near Evansville, and follows the Evansville and Terre Haute Railroad to Vincennes, where it was tied to the Coast and Geodetic Survey astronomic pier. From a point on this line at Princeton, Ind., a line was run along the Air Line Railroad to Mount Carmel, Ill., thence by Louisville and Nashville Railroad to Evansville, Ind., and tied to original point.

Geographic positions along the Evansville and Terre Haute Railroad, from Evansville to Vincennes.

Station.	Latitude.	Longitude.
	° ' "	° ' "
Junction point (1899).....	37 58 56.0	87 32 14.5
T. 6, R. 10, $\frac{1}{2}$ corner secs. 16 and 21.....	37 59 35.7	87 32 14.1
Church, $\frac{1}{2}$ mile northwest of, section corner at road.....	38 03 06.0	87 32 41.2
Inglefield, road crossing at.....	38 06 33.7	87 33 30.7
Inglefield station.....	38 06 36.6	87 33 31.0
T. 5, R. 10 W., corner secs. 5 and 6.....	38 07 27.1	87 33 49.5
Stagers, road crossing at.....	38 08 58.4	87 33 43.3
St. James, road crossing at.....	38 10 57.4	87 34 13.8
Haubstadt station.....	38 12 18.5	87 34 24.1
Fort Branch, corner secs. 13 and 18.....	38 14 47.2	87 34 32.7
Fort Branch station.....	38 14 56.1	87 34 43.7
King, road crossing at.....	38 18 17.5	87 34 31.3
Princeton station.....	38 21 22.3	87 34 24.8
Patoka station.....	38 24 15.4	87 35 11.9
North and south road crossing, telephone line.....	38 26 12.2	87 34 18.7
Hazelton station.....	38 29 20.4	87 32 33.4
Decker station.....	38 31 10.7	87 31 36.3
Siding, road crossing at.....	38 35 39.2	87 31 14.4
Road crossing, telephone line.....	38 37 58.2	87 30 46.0
Vincennes court-house, center of cupola (United States standard).....	38 40 35.2	87 31 37.3
Vincennes, astronomic latitude and longitude station (United States standard).....	38 40 35.7	87 31 35.0

Geographic positions along the Air Line Railroad from Princeton, Ind., to Mount Carmel, Ill.

Station	Latitude.	Longitude.
INDIANA.		
Princeton, 4 miles west of, north and south road crossing.....	° ' "	° ' "
	38 22 17.3	87 39 13.2
North and south road crossing, telephone line.....	38 22 50.0	87 41 10.1
T. 1 S., R. 12 W., corner secs. 27, 28, 33, and 34.....	38 23 36.1	87 44 12.8
ILLINOIS.		
Mount Carmel station, Air Line Railroad.....	38 24 16.2	87 45 25.7

72 PRIMARY TRIANGULATION AND PRIMARY TRAVERSE. [BULL. 20].

Geographic positions along Big Four Railway from Mount Carmel to Carmi, Ill.

Station.	Latitude.	Longitude.
Air Line and Big Four Railway Junction, point 300 feet southwest of, on Big Four Railway	38 24 34.2	87 46 27.8
T. 1 S., R. 12 W., center sec. 30	38 24 06.2	87 47 13.9
Schrodt's, road crossing at	38 22 59.6	87 49 21.3
Keen station	38 21 08.8	87 52 02.6
T. 2 S., R. 13 W., $\frac{1}{2}$ corner between secs. 18 and 19	38 20 04.8	87 54 00.0
Cowling station	38 18 41.2	87 56 13.1
Grayville station, Big Four Railway	38 15 38.9	87 59 29.4
Grayville, crossing at ferry	38 15 27.7	87 59 27.7
Calvin, $\frac{1}{2}$ mile northeast of, corner on township line	38 12 59.6	88 00 38.8
Calvin station	38 12 36.0	88 01 01.7
T. 4. S., Rs. 10 and 11 W., corner secs. 7, 12, 13, and 18	38 11 02.3	88 02 23.5
Crossville station	38 09 50.2	88 03 49.4
Road crossing, north and south	38 08 05.2	88 05 43.7
Carmi, junction of Big Four and Louisville and Nashville Railroads	38 05 47.4	88 09 20.4

Geographic positions along Louisville and Nashville Railroad from Carmi, Ill., to Evansville, Ind.

Station.	Latitude.	Longitude.
ILLINOIS.	° ' "	° ' "
Epworth, road crossing at	38 04 17.7	88 06 20.2
T. 5 S., R. 10 W., corner secs. 21, 22, 27, and 28	38 04 05.9	88 05 46.9
Maumee, road crossing at	38 02 10.5	88 02 45.9
INDIANA.		
T. 6 S., R. 14 W., corner secs. 8, 9, 16, and 17	38 00 42.7	87 59 13.8
Section line north and south, road crossing on	37 59 50.4	87 59 13.1
Upton, road crossing at	37 57 49.9	87 57 37.3
Mt. Vernon station	37 56 24.2	87 53 48.3
T. 7 S., R. 13 W., center sec. 3	37 56 40.9	87 51 32.0
Ts. 6 and 7 S., R. 13 W., corner secs. 1, 2, 35, and 36	37 57 05.8	87 49 51.2
Caborus, road crossing at	37 58 19.2	87 47 26.1
T. 6 S., R. 12 W., corner secs. 21, 22, 27, and 28	37 58 46.5	87 45 11.7
St. Phillips, road crossing at	37 58 56.2	87 42 56.9
North Howell, crossing Louisville and Nashville Railroad and street-car line	37 58 21.3	87 36 32.0

Geographic positions along Belt Railway, Evansville.

Station.	Latitude.	Longitude.
Evansville, crossing Belt Railway and Howell street-car line	° ' " 87 58 54.9	° ' " 87 35 24.7
Evansville, crossing Belt and I. C. Railroads	37 59 36.3	87 35 01.8
T. 6, R. 10, corner secs. 16, 17, 20, and 21	37 59 36.5	87 32 47.0

MICHIGAN.

PRIMARY TRAVERSE.

The following geographic positions were determined by primary traverse in 1901 by Mr. George T. Hawkins, topographer.

The line starts from the Presbyterian Church spire at Tecumseh, located by the United States Lake Survey, and follows the Lake Shore and Michigan Southern Railway to Ann Arbor, thence along Ann Arbor Railroad to New Hudson, thence along wagon road to Novi, thence along Pere Marquette Railroad to Detroit, and connected with the United States Lake Survey triangulation station, St. Paul's Church spire.

Geographic positions between Tecumseh and Chelsea.

Station.	Latitude.	Longitude.
Tecumseh, Presbyterian Church spire	° ' " 42 00 15.0	° ' " 83 56 54.6
T. 5 S., R. 4 E., $\frac{1}{2}$ corner between secs. 8 and 9	42 03 36.3	83 58 01.0
Clinton station, Lake Shore and Michigan Southern Railway	42 04 06.4	83 58 24.1
Ts. 4 and 5. S., township line between	42 04 42.6	83 58 33.0
T. 4 S., R. 4 E., $\frac{1}{2}$ corner between secs. 20 and 29	42 06 27.7	83 58 44.5
River Raisin, crossing at	42 07 19.4	83 58 57.8
T. 3 S., R. 3 E., corner secs. 25, 26, 35, and 36	42 10 35.8	84 01 55.7
T. 3 S., R. 3 E., corner secs. 13, 14, 25, and 26	42 11 29.4	84 01 57.5
Forks of three roads near house	42 14 22.8	84 02 14.7
T. 2 S., R. 3 E., corner secs. 25, 26, 35, and 36	42 15 29.2	84 02 03.2
Forks of road at cemetery	42 16 48.2	84 01 54.3

Geographic positions along Michigan Central Railroad, Chelsea to Ann Arbor.

Station.	Latitude.	Longitude.
Chelsea station	° ' " 42 19 09.7	° ' " 84 01 10.8
T. 2 S., R. 4 E., corner secs. 3, 4, 9, and 10	42 19 31.1	83 57 32.9
Dexter, crossing under railroad west of	42 20 22.5	83 53 32.8
Dexter station	42 20 25.7	83 53 03.1
Scio, road crossing at	42 19 27.9	83 50 20.2
Delhi station	42 19 49.5	83 48 37.1
Ann Arbor and Michigan Central Railroad crossing	42 17 24.9	83 44 45.3

74 PRIMARY TRIANGULATION AND PRIMARY TRAVERSE. [BULL. 20.]

Geographic positions along or near Ann Arbor Railroad from Ann Arbor to Hamburg.

Station.	Latitude.	Longitude.
	° ' "	° ' "
Ann Arbor, main street crossing	42 17 31.5	83 44 13.7
Ann Arbor, observatory dome	42 16 54.6	83 43 52.9
T. 2 S., R. 6 E., corner secs. 9, 10, 15, and 16	42 18 59.1	83 43 18.9
T. 2 S., R. 6 E., $\frac{1}{2}$ corner north side sec. 4 (?)	42 20 36.6	83 43 58.5
T. 2 S., R. 6 E., $\frac{1}{2}$ corner north side sec. 4 (?)	42 21 28.4	83 44 00.8
T. 1 S., R. 6 E., corner secs. 8, 9, 16, and 17	42 24 04.4	83 44 35.9
Whitmore station	42 25 21.7	83 45 56.9
Ts. 1 S. and 1 N., R. 6 E., corner on base line, 120 feet east of railroad	42 25 43.3	83 46 27.9

Geographic positions along Grand Trunk Railway, Hamburg to Anderson and Anderson to New Hudson.

Station.	Latitude.	Longitude.
	° ' "	° ' "
Hamburg station	42 26 50.2	83 48 02.7
T. 1 N., R. 5 E., $\frac{1}{2}$ corner between secs. 21 and 22	42 27 46.7	83 50 16.9
Grand Trunk and Ann Arbor Railroad crossing	42 27 44.6	83 50 30.1
Ann Arbor Railroad, crossing over	42 27 54.1	83 52 03.4
T. 1 N., R. 4 E., $\frac{1}{2}$ corner between secs. 23 and 24	42 27 39.9	83 55 38.0
Pinckney station	42 27 38.2	83 56 31.4
Road crossing, northwest and southeast	42 27 38.3	83 57 45.2
Section road, north and south	42 27 38.3	83 57 57.9
T. 1 N., R. 4 E., corner secs. 17, 18, 19, and 20	42 28 02.7	84 00 21.2
Anderson station	42 28 02.7	84 00 39.4
T. 1 N., R. 6 E., $\frac{1}{2}$ corner between secs. 30 and 31	42 26 29.7	83 46 37.9
Whitmore, road crossing at	42 26 20.5	83 44 43.0
Rushton, road crossing at	42 27 06.7	83 41 45.5
T. 1 N., Rs. 6 and 7 E., $\frac{1}{2}$ corner between secs. 25 and 30	42 27 10.5	83 39 58.2
Grand Trunk and Pere Marquette Railroad cross- ing	42 27 39.0	83 38 46.9
South Lynn station	42 27 39.8	83 38 46.9
T. 1 N., R. 7 E., corner secs 3, 4, 9, and 10	42 30 18.5	83 36 54.8
New Hudson station	42 30 31.4	83 36 43.4

Geographic positions along highways, New Hudson to Novi.

Station.	Latitude.	Longitude.
	° ' "	° ' "
N., R. 7 E., corner secs. 2, 3, 10, and 11	42 30 21.6	88 35 44.6
south	42 30 18.7	88 34 49.6
north	42 30 09.8	88 34 31.4
south	42 29 54.1	88 33 19.8
north and south	42 29 38.4	88 32 09.5
north and south	42 29 22.2	88 30 55.9
north and south	42 29 06.2	88 29 44.3

Geographic positions along the Pere Marquette Railroad, Novi to Detroit.

Station.	Latitude.	Longitude.
	° ' "	° ' "
, road crossing west of	42 28 55.5	88 28 55.9
, road crossing south of	42 28 32.9	88 28 31.3
N., R. 8 E., corner secs. 22, 23, 26, and 27	42 27 59.1	88 28 29.3
N., R. 8 E., corner secs. 26, 27, 34, and 35	42 27 06.9	88 28 26.7
crossing, northwest and southeast	42 23 45.9	88 28 08.0
south station	42 22 50.0	88 27 42.3
station	42 22 30.7	88 22 51.4
S., R. 9 E., $\frac{1}{2}$ corner between secs. 27 and 28	42 22 31.3	88 22 21.6
station	42 22 34.9	88 19 58.1
S., Rs. 9 and 10 E., $\frac{1}{2}$ corner between secs. 25 130	42 22 37.4	88 18 50.4
station	42 22 40.2	88 17 47.9
junction	42 22 44.5	88 14 16.9
S., Rs. 10 and 11 E., $\frac{1}{2}$ corner between secs. 25 130	42 22 47.1	88 11 52.7
Detroit, Michigan avenue crossing	42 19 52.3	88 07 02.2

WISCONSIN.

PRIMARY TRAVERSE.

The following geographic positions were determined by primary traverse by George T. Hawkins, topographer, in 1901. The line starts at the court-house in Milwaukee and follows the Chicago and Northwestern Railway to the north line of Ozaukee County.

Geographic positions along the Chicago and Northwestern Railway, from Milwaukee northward.

Station.	Latitude.	Longitude.
Milwaukee court-house dome	43 02 31.8	87 54 18.4
Lakeshore Junction station	43 05 16.9	87 53 40.5
Whitefish Bay station	43 07 04.4	87 54 09.9
Fox Point station	43 09 29.4	87 54 03.8
T. 8, R. 22, corner secs. 4, 5, 8, and 9	43 10 36.1	87 54 18.4
Douges Grove station	43 12 21.8	87 55 06.1
Mequon	43 18 14.9	87 55 09.7
Stone schoolhouse, section corner at	43 17 41.1	87 55 28.9
Ulao station, east and west crossing	43 19 13.5	87 54 58.4
Cedarsburg and Port Washington road, intersection on township line with east and west road	43 22 06.7	87 54 02.3
Port Washington station	43 23 14.2	87 52 56.7
Ts. 11 and 12, R. 22, corner of township line between	43 27 20.8	87 52 14.1
Belgium station	43 29 55.2	87 51 18.7
Ts. 12 and 13, R. 22, corner of secs. 2, 3, 34, and 35	43 32 34.6	87 50 27.7

MISSOURI.

PRIMARY TRAVERSE.

The following geographic positions were determined by primary traverse in 1901 by Mr. George T. Hawkins, topographer. The line starts from an adjusted position at Kirksville, determined by primary traverse in 1900, and follows the Wabash Railroad to Jacksonville; thence from Macon, along Hannibal and St. Joe Railroad, to Monroe; thence along Missouri, Kansas and Texas Railway to Hartman; thence along Hannibal and St. Joe Railroad to Hannibal, and connected with the United States Mississippi River Commission triangulation station Hannibal.

Geographic positions along Wabash Railroad.

Station.	Latitude.	Longitude.
Kirksville, Omaha, Kansas City and Eastern Railroad crossing	40 12 05.0	92 35 10.5
T. 62 N., R. 15 W., corner secs. 28, 29, 32, and 33	40 08 22.0	92 35 26.9
Millard station	40 06 26.1	92 32 47.2
T. 61 N., R. 15 W., corner secs. 11, 12, 13, and 14	40 05 44.6	92 32 00.9
T. 61 N., R. 15 W., corner on township line, south side secs. 31 and 32	40 02 14.3	92 29 46.9
Laplata station	40 01 27.2	92 29 23.5
T. 60 N., R. 14 W., corner secs. 17, 18, 19, and 20	39 59 57.9	92 29 37.6

Geographic positions along Wabash Railroad—Continued.

Station.	Latitude.	Longitude.
N., R. 14 W., $\frac{1}{4}$ corner between secs. 5 and 8 ita station	39 56 26.8 39 58 58.7	92 29 11.4 92 28 50.6
N., R. 14 W., corner on township line, south e secs. 32 and 33	39 52 06.5	92 28 37.9
N., R. 14 W., corner secs. 8, 9, 16, and 17 7 and 58 N., township line between	39 50 21.8 39 46 49.9	92 28 41.1 92 28 37.8
n station, Wabash Railroad	39 44 18.1	92 28 36.5
ibal and St. Joe Railroad crossing	39 44 16.4	92 28 36.8
N., R. 14 W., $\frac{1}{4}$ corner between secs. 27 and 28 crossing, east and west	39 42 58.8 39 40 48.1	92 27 51.9 92 28 38.7
llo station	39 38 11.8	92 28 30.0
5 and 56 N., corner secs. 3, 4, 33, and 34	39 36 28.6	92 28 09.9
sonville station	39 35 17.4	92 28 15.0

Geographic positions along Hannibal and St. Joe Railroad.

Station.	Latitude.	Longitude.
nel station	39 44 45.1	92 20 04.4
N., R. 13 W., corner secs. 10, 11, 14, and 15 2 and 13 W., line between	39 45 01.1 39 44 38.8	92 19 58.7 92 17 40.5
nce station	39 44 33.5	92 15 40.4
post 56, north and south road crossing near	39 43 53.2	92 12 08.4
ner station	39 43 07.3	92 08 51.3
N., R. 11 W., corner secs. 20, 21, 28, and 29	39 43 14.8	92 08 50.7
N., Rs. 10 and 11 W., corner secs. 30, 31, 36, 125	39 42 16.0	92 04 20.1
mina station	39 41 37.6	92 02 26.9
N., R. 9 W., $\frac{1}{4}$ corner between secs. 6 and 7 ewell station	39 40 27.0 39 40 00.1	91 57 00.9 91 51 39.0
and 9 W., line between	39 39 52.1	91 50 48.9
N., R. 8 W., corner secs. 8, 9, 16, and 17	39 39 30.8	91 48 34.9
oe station	39 39 08.8	91 44 15.3

Geographic positions along Missouri, Kansas and Texas Railway.

Station.	Latitude.	Longitude.
Monroe, 2 miles east of, section corner	° ' "	° ' "
Monroe, 3 miles east of, section corner	39 39 26.8	91 41 49.3
T. 56 N., Rs. 6 and 7 W., $\frac{1}{2}$ corner between secs. 7 and 8	39 39 26.2	91 40 41.8
Huntington, road crossing at	39 39 49.6	91 37 19.7
T. 56 N., R. 6 W., $\frac{1}{2}$ corner between secs. 3 and 10	39 39 40.6	91 35 56.1
Rensselaer station	39 40 14.7	91 33 25.1
Rs. 5 and 6 W., line between	39 40 22.9	91 33 15.7
Rs. 5 and 6 W., line between	39 40 47.9	91 31 44.6

Geographic positions along Hannibal and St. Joe Railroad.

Station.	Latitude.	Longitude.
Paris and Hannibal gravel road crossing	° ' "	° ' "
Paris and Hannibal gravel road crossing	39 41 07.1	91 26 07.9
New London and Hannibal gravel road crossing	39 40 58.5	91 24 10.9
Ts. 56 and 57 N., Rs. 4 and 5 W., corner between	39 41 06.7	91 23 53.1
New London and Hannibal dirt road crossing	39 41 54.1	91 22 28.1
Hannibal, Main street crossing	39 42 26.6	91 21 15.2

IOWA.**PRIMARY TRAVERSE.**

The following geographic positions were determined by primary traverse in 1901 by Mr. George T. Hawkins, topographer. The line starts from Postville station (established by primary traverse in 1899-1900 from triangulation by Mississippi River Commission) and follows the Chicago, Milwaukee and St. Paul Railway to county line 2 miles east of Cresco, thence north on highways to the Iowa-Minnesota State line, thence east to a church. A spur line starts from Calmar and follows the Dakota Division of same railway to Jackson Junction.

Geographic positions along Chicago, Milwaukee and St. Paul Railway.

Station.	Latitude.	Longitude.
Postville station	43 05 14.8	91 34 17.0
Castalia station	43 06 35.6	91 40 30.0
T. 96 N., R. 7 W., $\frac{1}{2}$ corner secs. 21 and 28	43 06 39.7	91 40 32.5
Ossian station	43 08 43.1	91 45 42.2
T. 96 N., R. 8 W., $\frac{1}{2}$ corner secs. 10 and 11	43 08 49.7	91 45 53.5
T. 97 N., R. 8 W., $\frac{1}{2}$ corner secs. 31 and 32	43 10 34.9	91 49 28.9
Calmar station	43 11 01.6	91 51 54.9
Conover station	43 13 01.1	91 53 52.2
T. 97 N., R. 9 W., northwest corner sec. 5	43 15 19.1	91 56 19.0
T. 98 N., R. 10 W., $\frac{1}{2}$ corner secs. 23 and 24	43 17 29.9	91 58 58.7
Ridgeway station	43 17 50.9	91 59 23.7
T. 98 N., R. 10 W., $\frac{1}{2}$ corner secs. 4 and 9	43 19 41.8	92 01 55.5

Geographic positions along highway.

Station.	Latitude.	Longitude.
T. 99 N., Rs. 10 and 11 W., corner secs. 19, 30, 24, and 25	43 22 16.6	92 04 50.0
T. 99 N., Rs. 10 and 11 W., corner secs. 7, 18, 13, and 12	43 24 01.6	92 04 49.8
Ts. 99 and 100 N., Rs. 10 and 11 W., corner between	43 25 44.6	92 04 48.9
T. 100 N., Rs. 10 and 11 W., corner secs. 7, 18, 13, and 12	43 29 13.9	92 04 48.3

Geographic positions along Iowa-Minnesota State line.

Station.	Latitude.	Longitude.
Iowa-Minnesota State line	43 30 03.6	92 04 31.1
Road south at church	43 30 03.0	92 00 38.6
Road north at church	43 30 03.1	92 00 34.7

Geographic positions along Dakota Division of Chicago, Milwaukee and St. Paul Railway.

Station.	Latitude.	Longitude.
T. 97 N., R. 9 W., $\frac{1}{2}$ corner between secs. 26 and 27	43 11 26.2	91 52 55.5
Fort Atkinson station	43 08 44.5	91 56 03.0
T. 96 N., R. 10 W., $\frac{1}{2}$ corner between secs. 13 and 14	43 08 00.7	91 59 00.1
Jackson Junction station	43 06 53.3	92 02 01.8

ARKANSAS.

PRIMARY TRAVERSE.

The following geographic positions were determined from primary traverse in 1901 by Mr. George T. Hawkins, topographer. The line starts from Gurdon station and follows the Iron Mountain Railway to Delight, thence via highways to the western edge of the Murfreesboro quadrangle.

Geographic positions along Iron Mountain Railway.

Station.	Latitude.	Longitude.
	° ' "	° ' "
Gurdon station	33 55 08.0	93 09 12.1
Okolona station	33 59 48.6	93 20 21.7
Antoine station	34 01 59.8	93 25 13.2
Delight station	34 01 46.4	93 30 12.4

Geographic positions along highways from Delight westward.

Station.	Latitude.	Longitude.
	° ' "	° ' "
Snellton, road south at	34 02 51.6	93 33 02.8
Brocktown post-office	34 04 09.0	93 36 26.0
Murfreesboro court-house	34 03 41.4	93 41 24.0
Sign board, Harris Ferry and Dallas	34 02 39.3	93 47 31.6
Church, road crossing 200 feet south of	34 02 35.7	93 49 16.8
Church, road crossing 200 feet west of	34 02 18.9	93 52 15.6
T. 8 S., R. 27 W., corner secs. 20, 21, 28, 29	34 02 21.8	93 53 36.3
Centerpoint, crossroads 1 mile east of	34 01 49.5	93 55 41.2
Centerpoint, crossroads 1 mile west of	34 01 16.4	93 57 48.0
T. 8 S., R. 28 W., $\frac{1}{2}$ corner between secs. 8 and 17	33 59 06.8	94 00 27.7

NEBRASKA.

PRIMARY TRAVERSE.

The following positions in Nebraska were determined by Mr. George T. Hawkins, topographer, in 1901. Starting from the United States Missouri River Commission triangulation station Otoe, the line follows the Burlington and Missouri River Railroad west to the Missouri Pacific Railway, thence along the latter railway to Hickman, thence along the Burlington and Missouri River Railroad to Union Pacific Railroad, via Lincoln and Ashland, to Plattsburgh, where line

was tied to United States Missouri River Commission triangulation station Plattsmouth:

Geographic positions along Burlington and Missouri River Railroad.

Station.	Latitude.	Longitude.
United States Missouri River Commission triangulation station Otoe.....	40 39 26.96	95 49 02.86
Nebraska City, road crossing under railroad.....	40 40 29.1	95 50 35.6
Nebraska City, crossing Missouri Pacific Railway under Burlington and Missouri River Railroad.....	40 40 25.4	95 50 46.9
T. 8 N., R. 13 E., corner secs. 14, 15, 22, and 23.....	40 39 19.4	95 55 58.5
T. 8 N., R. 13 E., corner secs. 17, 18, 19, and 20.....	40 39 17.6	95 59 23.4
T. 8 N., Rs. 12 and 13 E., corner secs. 13, 18, 19, and 24.....	40 39 20.7	96 00 33.1

Geographic positions along Missouri Pacific Railway.

Station.	Latitude.	Longitude.
Lorton station.....	40 35 56.1	96 01 11.4
T. 7 N., R. 12 E., corner secs. 14, 23, and 24.....	40 34 07.6	96 01 38.4
T. 7 N., Rs. 11 and 12 E., corner on township line between secs. 31 and 36.....	40 32 24.3	96 06 29.5
T. 6 N., R. 11 E., corner secs. 1, 2, 11, and 12.....	40 31 32.1	96 07 14.8
T. 6 N., R. 11 E., corner secs. 2, 3, 10, and 11.....	40 30 39.1	96 09 31.8
Cook station.....	40 30 36.0	96 09 38.6
Rs. 10 and 11 E., crossing of line between.....	40 31 16.6	96 14 04.3
T. 7 N., R. 10 E., $\frac{1}{2}$ corner between secs. 33 and 34.....	40 31 57.0	96 17 29.5
Burr station.....	40 32 15.2	96 17 58.9
T. 7 N., R. 9 E., corner secs. 11, 12, 13, and 14.....	40 35 00.2	96 22 00.2
Douglas station.....	40 35 30.4	96 22 59.1
T. 7 N., R. 9 E., corner secs. 5, 6, 7, and 8.....	40 35 47.3	96 26 34.7
Rs. 8 and 9 E., crossing of line between.....	40 36 17.1	96 27 42.3
Panama, $\frac{1}{4}$ mile southeast of, crossroads.....	40 35 52.7	96 29 58.2
Panama station.....	40 36 03.3	96 30 28.2
Ts. 7 and 8 N., R. 8 E., corner secs. 5, 6, 31, and 32.....	40 36 47.9	96 33 26.3
T. 7 N., Rs. 7 and 8 E., corner secs. 2, 3, 34, and 35.....	40 36 47.7	96 36 29.9
Hickman station, Missouri Pacific Railway.....	40 37 11.5	96 37 40.6

Geographic positions on Burlington and Missouri River Railroad.

Station.	Latitude.	Longitude.
Hickman station	° ' "	° ' "
Missouri Pacific and Burlington and Missouri River Railroad crossing	40 37 20.9	96 37 57.1
T. 8 N., R. 7 E., $\frac{1}{4}$ corner between secs. 20 and 29	40 38 01.2	96 38 42.4
	40 38 30.7	96 39 20.7

Geographic positions along Union Pacific Railroad.

Station.	Latitude.	Longitude.
T. 8 N., Rs. 6 and 7 E., corner on township line between secs. 1 and 6	° ' "	° ' "
40 41 53.6	96 41 30.6	
Jamaica station	40 41 00.2	96 41 00.2
Union Pacific and Chicago, Rock Island and Pacific Railroad crossing	40 43 36.9	96 43 36.9
T. 9 N., R. 6 E., corner secs. 2, 3, 10, and 11	40 46 21.6	96 46 21.6
Lincoln, Union Pacific and Burlington and Missouri River Railroad crossing	40 48 42.2	96 48 42.2

Geographic positions along Pacific and Missouri River Railroad.

Station.	Latitude.	Longitude.
Lincoln sta ^t	40 49 04.0	96 42 34.2
Fremont ^t station, valley and bridge crossing	40 50 18.3	96 40 48.8
Hay ^t station	40 51 37.1	96 38 18.6
Havelock station, north east of	40 52 05.2	96 37 21.2
T. 11 N., R. 11 E., corner secs. 35, and 36	40 53 15.2	96 35 03.6
Waverly station	40 55 11.2	96 31 29.8
T. 11 N., R. 8 E., corner secs. 14, and 15	40 55 52.9	96 29 58.6
Greenwood station	40 57 52.6	96 26 24.4
T. 12 N., R. 9 E., corner between secs. 21 and 28	40 59 20.5	96 24 52.9
T. 12 N., R. 9 E., corner secs. 10, 11, 14, and 15	41 01 03.8	96 23 09.0
Ashland station	41 02 22.8	96 21 32.0
Southbend station	41 00 24.4	96 14 36.9
T. 12 N., R. 10 E., $\frac{1}{4}$ corner between secs. 13 and 24	41 00 14.5	96 14 36.9
Chicago, Rock Island and Pacific and Burlington and Missouri River Railroad crossing	40 59 59.8	96 14 06.1
Louisville station	41 00 18.8	96 09 42.8
Missouri Pacific and Burlington and Missouri River Railroad crossing	41 00 22.7	96 09 31.1
T. 12 N., R. 11 E., corner secs. 14, 15, 22, and 23	41 00 12.8	96 09 28.6
Cedar Creek station	41 02 21.0	96 06 03.3
Cullom, road crossing north and south	41 03 26.7	96 01 18.6
Omaha Junction, blockhouse at	41 02 59.8	95 55 11.5

ROCKY MOUNTAIN SECTION OF TOPOGRAPHY.

WYOMING-COLORADO.

TRIANGULATION STATIONS.

Wyoming.

This work depends on a base line 4.6 miles in length, measured westward along the railroad tangent, beginning $2\frac{1}{2}$ miles west of Fort Steele. The line was prepared in the usual manner by nailing boards and zinc strips to the cross-ties. Three complete measurements were made with standard 300-foot tape No. 1, temperatures being taken by two Standard thermometers at each tape length.

The length of base reduced to sea level is 24,181.420 feet.

Logarithm of length in meters=3.8674977.

Positions depend upon the latitude and longitude pier of the Wheeler survey, established in 1872, corrected for the revised longitude of Salt Lake, from which it was originally determined. The astronomic point was occupied as an azimuth station on two nights, and a check azimuth was observed near milepost 145 on the Colorado-Wyoming State line. During the progress of this work 12 primary and 4 secondary stations were occupied, and numerous high peaks were located by intersections, controlling three 30-minute quadrangles in Wyoming and one in Colorado.

Angles were measured and azimuths were observed with an 8-inch micrometer theodolite by Mr. Frank Tweedy, topographer, who also prepared and measured the base line.

AZIMUTH MARK, CARBON COUNTY.

Situated one-half mile west of Fort Steele, on end of spur just south of Fort Steele-Rawlins wagon road.

Station mark: A stone post, 24 by 10 by 6 inches, in center of top of which is cemented a bronze tablet.

[Latitude $41^{\circ} 46' 39.02''$. Longitude $106^{\circ} 57' 30.53''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Greenville.....	63 27 32.85	243 22 34.11	4.0640571
East base.....	97 03 40.20	277 02 01.27	3.5384929
Mount Steele.....	154 41 30.14	334 39 55.60	3.8839366
St. Marys.....	257 18 45.01	77 23 25.44	3.9982118
Astronomic station.....	267 28 15.63	87 28 40.30	2.9324543

BATTLE, CARBON COUNTY.

(Not occupied.)

The highest point of a high, isolated, volcanic, flat-topped butte on north side of Snake River, about 6 miles west of Honnold post-office.

[Latitude $41^{\circ} 02' 01.7''$. Longitude $107^{\circ} 16' 56.1''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Bridger	° ' "	° ' "	<i>Meters.</i>
290 37 45	50 47 37	4.43369	
Hahn	805 09 57	125 23 48	4.56094

BRIDGER, CARBON COUNTY.

Situated about $3\frac{1}{2}$ miles northwest of Battle post-office, on the Continental Divide, on highest peak in the Grand Encampment country, locally known as Bridger Peak, and called the Grand Encampment Peak by the King survey.

Station mark: A bronze tablet cemented in solid rock, over which is built a cairn.

[Latitude $41^{\circ} 11' 18.86''$. Longitude $107^{\circ} 01' 55.61''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Sage	° ' "	° ' "	<i>Meters.</i>
177 24 12.03	357 23 06.03	4.7072903	
Platte	202 02 02.02	22 10 10.03	4.6589063
Needle	245 23 13.02	65 35 34.45	4.4591810
Riverside	260 04 54.00	80 14 59.00	4.3371700
Pelham	300 08 45.04	120 22 27.61	4.5288192
Zirkel	324 04 46.00	144 18 09.00	4.6791800
Hahn	347 17 16.00	167 21 17.00	4.5925200

EAST BASE, CARBON COUNTY.

Situated about 3 miles west of Fort Steele, 575 feet south of Union Pacific Railway track at east end of a $4\frac{1}{2}$ -mile tangent and near end of a low ridge running parallel with track.

Station mark: A stone post, 36 by 10 by 6 inches, set 32 inches in the ground, in the center of top of which is cemented a bronze tablet.

Reference marks: An iron bench-mark post set 20.01 feet north and at right angles to base line. An iron bench-mark post set 20.14 feet south and at right angles to base line. An iron bench-mark post set 20.24 feet east and on prolongation to base line.

[Latitude 41° 46' 52.76". Longitude 106° 59' 59.02".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Greenville	° ' "	° ' "	<i>Meters.</i>
51 03 02.68	230 59 42.81	3.9503037	
West base	88 33 43.25	268 30 10.67	3.8674977
Mount Steele	181 21 18.96	1 21 23.40	3.8127309
Azimuth mark	277 02 01.27	97 03 40.20	3.5384929

FORT STEELE, ASTRONOMIC STATION, CARBON COUNTY.

Situated about 700 feet southeast of railroad station at Fort Steele, across a small gulch 6 feet deep and about 500 feet southwest of the Fort Steele Hotel.

Station mark: An iron bench-mark post projecting 6 inches above ground.

The station is described in Wheeler's report of 1872, and was originally marked by a pine post 3 feet in diameter and 2½ feet high above ground, but was sawed off and sides chopped away until in 1901 it stood but 1 foot above the ground. It was entirely decayed beneath the surface of ground and was dug up and replaced by the iron post noted above.

[Latitude 41° 46' 40.24". Longitude 106° 56' 53.50".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Azimuth station	° ' "	° ' "	<i>Meters.</i>
87 28 40.30	267 28 15.63	2.9324543	
Mount Steele	149 03 17.53	329 01 18.80	3.9044541

GRENNVILLE, CARBON COUNTY.

Situated about 3 miles south of Grennvile station on the Union Pacific Railway, on a small rise on east and west ridge, about one-half mile west of old road graded across ridge.

Station mark: An iron bench-mark post.

[Latitude 41° 43' 50.92". Longitude 107° 04' 59.14".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Rawlins	° ' "	° ' "	<i>Meters.</i>
175 23 17.22	355 23 04.61	4.24470	
West base	210 18 27.78	31 21 52.20	3.7355056
Mount Steele	230 59 42.81	51 03 02.68	4.1469299
East base	243 22 34.11	63 27 32.85	3.9503037
Azimuth mark	249 46 34.31	69 56 13.40	4.0640571
St. Mary	348 14 11.45	168 15 07.15	4.3302481
Sage			3.9780430

HONNOLD, CARBON COUNTY.

(Walsh Hill of King survey.)

A sharp mountain about 2 miles northwest of Honnold post-office, Colorado, and 1 mile north of Snake River. The Colorado-Wyoming line crosses south slope of mountain.

Station mark: A bronze tablet set in bed rock on highest knob, over which a cairn is built.

[Latitude $41^{\circ} 00' 42.3''$. Longitude $107^{\circ} 11'' 11.5''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Bridger	° ' "	° ' "	<i>Meters.</i>
	213 23 55	33 30 00	4.37173
Hahn	310 33 47	130 42 52	4.45439

MEDICINE BOW, NEAR ALBANY-CARBON COUNTY LINE.

(Not occupied.)

The highest point of Medicine Bow or Snowy Mountains, between the valleys of the Platte and Laramie rivers. It is a massive, round-topped mountain, locally known as Medicine Bow Peak, and is the highest peak of southern Wyoming, reaching an elevation of about 12,000 feet.

[Latitude $41^{\circ} 21' 44.6''$. Longitude $106^{\circ} 19' 03.7''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Pelham	° ' "	° ' "	<i>Meters.</i>
	-----	-----	4.67777
Needle	-----	-----	4.53721
Sage	-----	-----	4.84246
St. Mary	-----	-----	4.81382

MOUNT STEELE, CARBON COUNTY.

Situated about 6 miles northwest of Fort Steele, on a high, sharp, rocky point on long ridge northeast of Platte River.

Station mark: A cairn $5\frac{1}{2}$ feet high with a 2 by 4 inch scantling in center.

Reference mark: A bronze tablet set in rock, 8 by 8 by $1\frac{1}{2}$ feet, $5\frac{1}{2}$ feet southeast of center of monument.

[Latitude $41^{\circ} 50' 28.30''$. Longitude $106^{\circ} 59' 52.36''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
East Base	• 1 21 28.40	181 21 18.96	3.8127309
Sage	13 33 08.62	193 30 40.12	4.3429037
Grennvile	30 21 52.20	210 18 27.78	4.1469299
West base	48 23 30.91	228 19 53.77	4.0026039
St. Mary	289 59 43.19	110 05 58.35	4.1406194
Astronomic station	329 01 18.30	149 03 17.53	3.9044541
Platte	334 38 42.02	154 45 31.16	4.5221187
Azimuth mark	334 39 55.60	154 41 30.14	3.8839366

NEEDLE, CARBON COUNTY.

Situated on the highest point of a square-topped granite butte at junction of Grand Encampment Creek and North Platte River. Station on south side of creek.

Station mark: A bronze tablet cemented in solid rock, over which is built a cairn.

[Latitude $41^{\circ} 17' 45.92''$. Longitude $106^{\circ} 43' 10.92''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
•	• 65 35 34.45	245 23 13.02	4.4591810
Bridger	144 01 11.25	323 47 40.35	4.6833258
Sage	163 32 31.31	343 28 15.59	4.4997329
Platte	169 41 00.82	349 36 09.80	4.7525844
St. Mary	354 11 03.96	174 12 27.10	4.4641739

PELHAM, CARBON COUNTY.

Situated on a high peak $2\frac{1}{2}$ miles north of divide between Grand Encampment Creek and waters of Big Creek where crossed by Columbine road. It is $2\frac{1}{2}$ miles north of Colorado-Wyoming State line, is locally known as "Rocky," and is the point called Pelham of the King survey.

Station mark: A bronze tablet cemented in solid rock under a cairn 5 feet high.

[Latitude 41° 02' 06.84". Longitude 106° 41' 04.61".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Hahn	° ' "	° ' "	<i>Meters.</i>
	44 25 12.00	224 15 33.00	4.4708300
Three Point	74 56 19.00	254 51 31.00	4.0256800
Bridger	120 22 27.61	300 08 45.04	4.5288192
Sage	155 18 55.41	335 04 03.17	4.8741960
Platte	168 40 04.50	348 34 26.07	4.7814746
Needle	174 12 27.10	354 11 03.96	4.4641739

PLATTE, CARBON COUNTY.

Situated about 7 miles north of Saratoga, on ridge, 1½ miles east of Platte River and one-third mile east of main road from Fort Steele to Saratoga.

Station mark: An iron bench-mark post.

[Latitude 41° 34' 08.19". Longitude 106° 49' 37.36".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Bridger	° ' "	° ' "	<i>Meters.</i>
	22 10 10.03	202 02 02.02	4.6589063
Sage	114 09 15.77	293 59 59.30	4.3274380
St. Mary	177 16 11.17	357 15 36.36	4.4043905
Needle	343 8 15.69	163 32 31.31	4.4997329
Pelham	348 34 26.07	168 40 04.50	4.7814746

RAWLINS, CARBON COUNTY.

(Not occupied.)

A round-topped point about 1 mile northwest of Rawlins monument.

[Latitude 41° 48' 23.4". Longitude 107° 16' 07.0".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Mount Steele	° ' "	° ' "	<i>Meters.</i>
			4.35788
West base			4.18404
Grennvile			4.24470

RIVERSIDE, CARBON COUNTY.

(Secondary point.)

In eastern edge of town of Riverside, at junction of Encampment-Santiago road and Encampment-Collins road. Station is at the north-west corner of township 14 north, range 83 west.

[Latitude $41^{\circ} 18' 19.2''$. Longitude $106^{\circ} 46' 36.4''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Bridger	80 14 59.00	260 04 54.00	4.83717
Needle	210 09 14.00	30 11 29.00	3.97853

SAGE, CARBON COUNTY.

Situated about 9 miles southwest of Fort Steele, on south edge of mesa overlooking Sage Creek drainage.

Station mark: A rock monument 9 feet high.

Reference mark: A bronze table cemented in solid rock, 5.15 feet northeast of monument.

[Latitude $41^{\circ} 38' 49.24''$. Longitude $107^{\circ} 03' 35.38''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Greenville	168 15 07.15	348 14 11.45	3.9780430
Mount Steele	198 30 40.12	13 38 08.62	4.3429037
St. Mary	227 22 13.37	47 30 56.25	4.3918929
Platte	293 59 59.30	114 09 15.77	4.3274390
Needles	323 47 40.35	144 01 11.25	4.6883258
Pelham	335 04 03.17	155 18 55.41	4.8741960
Bridger	357 23 06.03	177 24 12.03	4.7072908

ST. MARY, CARBON COUNTY.

Situated $2\frac{1}{2}$ miles north of Wolcott station on Union Pacific Railway, on a high bare point.

Station mark: A bronze triangulation tablet set in a rock, 10 by 5 by 2 feet, over which is built a cairn 6 feet high.

[Latitude $41^{\circ} 47' 49.70''$. Longitude $106^{\circ} 50' 29.71''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Sage	47 30 56.25	227 22 13.37	4.3918929
Greenville	69 56 13.40	249 46 34.31	4.3302481
Azimuth mark	77 23 25.44	257 18 45.01	3.9982118
Mount Steele	110 05 58.35	289 59 43.19	4.1406194
Platte	357 15 36.36	177 16 11.17	4.4043905

SARATOGA, CARBON COUNTY.

(Not occupied.)

Station mark: The cupola on the high school at Saratoga.

[Latitude $41^{\circ} 27' 32.1''$. Longitude $106^{\circ} 48' 54.0''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Sage	° ' "	° ' "	<i>Meters.</i>
Platte			4.46565 4.08854

SHARP, CARBON COUNTY.

(Not occupied.)

An isolated, rocky, and partially timbered hill, about 7 miles north of Bridger Peak.

[Latitude $41^{\circ} 17' 01.1''$. Longitude $107^{\circ} 00' 49.6''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Needle	° ' "	° ' "	<i>Meters.</i>
Bridger			4.39224 4.02808

THREE POINT, CARBON COUNTY.

(Secondary point.)

On rocky hill covered with burnt timber, about 1 mile north of Columbine road crossing of Grand Encampment River.

Station mark: A bedrock granite boulder, 4 by 3 by 2 feet, in top of which is drilled a 1-inch hole.

[Latitude $41^{\circ} 00' 37.2''$. Longitude $106^{\circ} 48' 23.0''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Pelham	° ' "	° ' "	<i>Meters.</i>
	254 51 31	74 56 19	4.02568

WEST BASE, CARBON COUNTY.

Situated one-third mile east of Grennvile station, 275 feet south of Union Pacific Railway track, $7\frac{1}{2}$ miles west of Fort Steele.

Station mark: A stone post, 30 by 12 by 8 inches, in center of top of which is cemented a bronze tablet.

Reference marks: An iron bench-mark post set 19.99 feet north and at right angles to base line. An iron bench-mark post set 20 feet south and at right angles to base line. An iron bench-mark post set 20 feet east and on base line.

[Latitude $41^{\circ} 46' 46.64''$. Longitude $107^{\circ} 05' 18.07''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Mount Steele.....	228 19 53.77	48 23 30.91	4.0026039
East base	268 30 10.67	88 33 43.25	8.8674977
Grennvile	355 28 04.61	175 28 17.22	8.7355056

Colorado.

ANITA, ROUTT COUNTY.

(Not occupied.)

The western of two high knobs on mountain ridge at head of Slater Creek, about 16 miles southwest of Honnold post-office, locally known as "Bears Ears."

Station mark: Highest point of knob.

[Latitude $40^{\circ} 48' 46.5''$. Longitude $107^{\circ} 14' 58.9''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Brider	201 53 04	22 01 38	4.68995
Hahn	254 51 50	75 04 22	4.44605

AZIMUTH STATION, ROUTT COUNTY.

(Secondary point.)

Situated in meadow at crossing of Grand Encampment River by Columbine road.

Station mark: A post 6 inches in diameter set 2 feet in the ground.

[Latitude $41^{\circ} 00' 10.9''$. Longitude $106^{\circ} 48' 51.1''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Three Point	218 59 51	39 00 10	3.01856

HAHN, ROUTT COUNTY.

(A secondary point.)

Situated about 2 miles east of Columbine post-office, on high peak; can be reached by road and mine trails from Columbine.

Station mark: A bronze tablet cemented in rock, over which is built a cairn 5 feet high.

[Latitude $40^{\circ} 50' 41.3''$. Longitude $106^{\circ} 55' 48.0''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Whitehead	° ' "	° ' "	Meters.
Whitehead	45 20 08	225 15 33	4.14266
Anita	75 04 22	254 51 50	4.44605
Battle	125 23 48	305 09 57	4.56034
Honnold	130 42 52	310 32 47	4.45439
Bridger	167 21 17	347 17 16	4.59252
Pelham	224 15 33	44 25 12	4.47083
Zirkel	274 05 45	94 15 05	4.30352

HIGH SHARP, ROUTT COUNTY.

(Not occupied.)

A sharp, lone peak, 7 miles south of Dixon post-office, on Snake River. Probably Navesink Peak of the King survey.

[Latitude $40^{\circ} 55' 13.8''$. Longitude $107^{\circ} 27' 28.8''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Bridger	° ' "	° ' "	Meters.
Bridger	230 00 38	50 17 22	4.66731
Pelham	258 38 20	79 08 43	4.82087

WHITEHEAD, ROUTT COUNTY.

(Not occupied.)

A high mountain peak about 8 miles southwest of Columbine post-office, locally known as Sand Mountain or Whitehead Mountain.

Station mark: A dead tree on highest point.

[Latitude $40^{\circ} 45' 24.6''$. Longitude $107^{\circ} 02' 49.1''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Bridger	° ' "	° ' "	Meters.
Bridger	181 29 26	1 30 01	4.68090
Hahn	225 15 33	45 20 08	4.14266

ZIRKEL, ROUTT COUNTY.

(Not occupied.)

A sharp, ragged, rocky peak on Continental Divide, about 14 miles east of Columbine post-office. The highest pinnacle of a rock comb was sighted. Mount Zirkel is probably about 4 miles southeast of this point.

[Latitude $40^{\circ} 49' 58.8''$. Longitude $106^{\circ} 41' 31.7''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Hahn -----	° ' "	° ' "	<i>Meters.</i>
Brider -----	94 15 05	274 05 45	4.30352
	144 18 09	324 04 46	4.68918

MILEPOST 145, COLORADO-WYOMING STATE LINE.

(Not occupied.)

In swamp between Columbine road and Grand Encampment River, about 500 feet west of river crossing.

Station mark: A pine post 6 by 6 inches by 5 feet high.

[Latitude $41^{\circ} 00' 17.8''$. Longitude $106^{\circ} 48' 57.8''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Three Point -----	° ' "	° ' "	<i>Meters.</i>
	333 31 39	53 32 02	3.00454

MILEPOST 163, COLORADO-WYOMING STATE LINE.

On a flat one-half mile west of Honnold post-office.

Station mark: A cut stone monument 60 by 18 by 18 inches.

[Latitude $41^{\circ} 00' 18.9''$. Longitude $107^{\circ} 09' 24.1''$.]

WYOMING.

TRIANGULATION STATIONS.

Two 30-minute quadrangles in Sheridan and Johnson counties, Wyo., were controlled by triangulation based upon Beckton and Soldier creeks, established by W. S. Post in 1896. Eleven stations were occupied and a check azimuth was observed near Buffalo by Mr. Frank Tweedy, topographer, during the field season of 1900.

AZIMUTH STATION, JOHNSON COUNTY.

Situated one-fourth mile west of Main street, Buffalo, on top of a rise of 50 feet above Clear Creek south of ice house and dry ice pond.

Station mark: A stone post 36 inches long, 12 inches square at base and 8 inches square at top, set 32 inches in the ground, in top of which is cemented a bronze meridian tablet. Station is the same as the south meridian mark.

[Latitude 44° 20' 37.06". Longitude 106° 42' 02.34".]

To station—	Azimuth.	Back azimuth.	Log. distance.
McKinney	68 50 56.48	248 47 25.29	<i>Meters.</i> 3.8561753
Buffalo	185 04 05.30	5 04 27.74	3.9049104

BUFFALO, JOHNSON COUNTY.

Situated on a grassy point on east and west ridge, about 4 miles north of Buffalo and 3 miles south of Lake De Smet. It is 2½ miles east of Sheridan-Buffalo stage road.

Station mark: A standard iron bench-mark post.

[Latitude 44° 24' 56.31". Longitude 106° 41' 30.26".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Azimuth station	5 04 27.74	185 04 05.30	<i>Meters.</i> 3.9049104
McKinney	34 58 02.87	214 54 09.10	4.1114584
Ten Sleep	61 46 22.30	241 29 00.70	4.5743590
Cloud Peak	84 45 13.80	264 25 02.95	4.5851407
Shell	123 47 10.45	303 41 39.91	4.0987021
Banner	137 58 13.68	317 48 15.32	4.4489394
Prairie Dog	166 21 40.71	346 18 59.87	4.3315864
Cross H	354 21 26.45	174 22 17.18	4.2141446

CONE, JOHNSON COUNTY.

(Not occupied.)

Situated on sharp cone on broken mesa ridge between French and Sand creeks, about 2 miles west of road between Buffalo and Upper Rock Creek.

[Latitude 44° 22' 39.4". Longitude 106° 47' 03.7".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Shell	164 42 45	344 41 08	<i>Meters.</i> 4.06487
Buffalo	240 09 34	60 13 27	3.92973

CROSS H, JOHNSON COUNTY.

Situated 1 mile south of Cross H ranch and three-fourths mile east of Buffalo-Casper stage road, on the northwest corner of mesa.

Station mark: A standard iron bench-mark post.

[Latitude $44^{\circ} 16' 08.40''$. Longitude $106^{\circ} 40' 17.67''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Ten Sleep	87 36 37.40	267 18 26.50	4.5404024
Cloud Peak	107 45 40.40	287 24 40.40	4.6223708
McKinney	123 19 06.93	302 14 22.78	4.0281338
Buffalo	174 22 17.18	354 21 26.45	4.2141446

DE SMET, JOHNSON COUNTY.

(Not occupied).

Situated on a high, sharp, reddish point, $1\frac{1}{2}$ miles east of north end of Lake De Smet and 3 miles south of Piney Creek.

Station mark: A cairn.

[Latitude $44^{\circ} 29' 59.8''$. Longitude $106^{\circ} 43' 36.1''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Shell	72 38 32	252 34 29	3.90394
Buffalo	343 26 43	163 28 11	3.98996

M'KINNEY, JOHNSON COUNTY.

Situated on east slope of mountain ridge, three-fourths mile south of mouth of Clear Creek Canyon and 3 miles east of Fort McKinney.

Signal: A large pine tree at point where ridge breaks down abruptly to the plain at head of steep gulch.

Station mark: A bronze triangulation tablet cemented in large granite boulder at west foot of tree. Distance to center of tree, 3 feet.

[Latitude $44^{\circ} 19' 13.00''$. Longitude $106^{\circ} 47' 04.55''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Banner	160 00 02.73	339 53 59.02	4.5248164
Shell	170 10 14.59	350 08 38.23	4.2511675
Prairie Dog	184 12 20.47	4 13 33.92	4.4987622
Buffalo	214 54 09.10	34 58 02.87	4.1114584
Azimuth station	248 47 25.29	68 50 56.48	3.8561753
Cross H	302 14 22.78	122 19 06.93	4.0281338

SHELL, JOHNSON COUNTY.

Situated on grassy butte between North and South forks of Shell Creek, about $2\frac{1}{2}$ miles west of Sheridan-Buffalo stage road and 1 mile south of Buell's ranch on North Fork of Shell Creek.

Station mark: A standard iron bench-mark post.

[Latitude $44^{\circ} 28' 42.17''$. Longitude $106^{\circ} 49' 22.29''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Buffalo	303 41 39.91	123 47 10.45	4.0987021
McKinney	350 08 38.23	170 10 14.59	4.2511675

BANNER, SHERIDAN COUNTY.

Situated on east end of mountain ridge sloping north to Big Horn and east to Banner post-office, about 4 miles east of Banner. Reached by old road from Banner.

Signal: A tall pine tree, the last high tree on east end of ridge, slightly down on south side of ridge. It is conspicuous from the north and south.

Station mark: A bronze triangulation tablet cemented in solid rock; azimuth to signal tree, $7^{\circ} 13'$; distance, 40.7 feet.

[Latitude $44^{\circ} 36' 12''$.00. Longitude $106^{\circ} 55' 43.81''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Beckton	149 30 03.39	329 25 06.37	4.2627415
McCormick	190 49 10.61	10 50 13.75	4.0227657
Prairie Dog	269 57 47.37	90 05 05.62	4.1387356
Buffalo	317 48 15.32	187 58 13.68	4.4489894
McKinney	339 53 59.02	160 00 02.73	4.5248104

GEORGE, SHERIDAN COUNTY.

Situated on a peaked butte on ridge on east side of main Prairie Dog Creek and about 3 miles east of Sheridan.

Station mark: A standard iron bench-mark post.

[Latitude $44^{\circ} 46' 23.52''$. Longitude $106^{\circ} 52' 47.28''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
McCormick	12 37 07.26	192 36 06.25	8.9413366
Beckton	76 47 56.20	256 40 54.44	4.1314607
Soldier	118 39 22.38	298 31 44.91	4.2107574
Prairie Dog	332 23 31.18	152 28 45.96	4.8288742

M'CORMICK, SHERIDAN COUNTY.

Situated about 6 miles east of Big Horn, on a grassy hill between Prairie Dog and McCormick creeks.

Station mark: A standard iron bench-mark post.

[Latitude $44^{\circ} 41' 47.32''$. Longitude $106^{\circ} 54' 18.96''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Banner.....	10 50 13.75	190 49 10.61	4.0227657
Beckton.....	115 43 44.50	295 37 44.01	4.0972845
Soldier.....	142 51 56.14	322 45 20.00	4.3109496
George.....	192 36 06.26	12 37 07.26	8.9413366
Prairie Dog	311 17 06.05	131 23 21.52	4.1953394

PRAIRIE DOG, SHERIDAN COUNTY.

Situated on south end of high point on divide between Prairie Dog and Piney creeks, at head of Murphy Gulch. A road from Prairie Dog to Bigred post-office crosses ridge one-half mile north of station.

Station mark: A bronze triangulation tablet, cemented in solid rock.

[Latitude $44^{\circ} 36' 11.82''$. Longitude $106^{\circ} 45' 19.69''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
McKinney.....	4 18 33.92	184 12 20.47	4.4987622
Banner.....	90 05 05.62	269 57 47.37	4.1887356
Beckton.....	124 29 27.56	304 17 11.73	4.4461406
McCormick	181 28 21.52	311 17 06.05	4.1953394
George.....	152 28 45.96	382 23 31.18	4.3288742
Buffalo.....	346 18 59.87	166 21 40.71	4.3815864

MERIDIAN MARKS.

BUFFALO, JOHNSON COUNTY.

Location of station: On rise of ground 50 feet above Clear Creek and 1,400 feet south of fence surrounding Buffalo high school. It is one-fourth mile east of the main street of Buffalo. It is above (south of) ice house and ice pond.

Station mark: A limestone post, 36 inches long, cut 8 inches square at top, set 32 inches in the ground, and in center of top is cemented a bronze meridian tablet.

Distant mark: North of station 1,400 feet, at base of fence surrounding Buffalo high school; a limestone post 36 inches long and cut 8 inches square at top, set 32 inches in the ground, in the center of top of which is cemented a bronze meridian tablet; true azimuth, $179^{\circ} 58' 01.15''$; north mark is set 9.69 inches too far west.

MONTANA.

TRIANGULATION STATIONS.

Positions in northwestern Montana, published herewith, result from the field work of Messrs. S. S. Gannett, A. H. Thompson, H. L. Baldwin, Jr., and R. H. Chapman, in the years 1897 to 1901, inclusive. They are based upon a geodetic latitude and longitude found by taking the mean of the astronomic positions, as determined at Hamilton and Helena stations, which were connected through a series of quadrilaterals.

Seven positions of stations in the expansion of the Hamilton base, published in the nineteenth annual report, are now republished with corrected values.

The Helena astronomic station is a primary astronomic station of the United States Coast and Geodetic Survey, situated near the United States assay office at Helena, and connected by measurements with the court-house spire.

The observed latitude of the pier is $46^{\circ} 35' 18.3''$.

The observed longitude of the pier is $112^{\circ} 02' 11.84''$.

The corresponding position of the court-house spire is, latitude $46^{\circ} 35' 17.5''$; longitude $112^{\circ} 02' 06.94''$.

To obtain the geodetic positions adopted, subtract from above $1.57''$ for latitude, and $2.13''$ for longitude.

The Helena base (Lewis and Clarke County) was measured twice at night with the 300-foot standard steel tape, along the roadbed of the Northern Pacific Railroad near Helena, by Mr. R. H. Chapman, topographer, in 1897. The resulting length, when reduced to sea level and corrected for temperature and inclination, is 6,511.77 meters.

The Hamilton astronomic station is situated on the eastern side of the railroad right of way, 50 feet east of the eastern rail of track, 80 feet northeast of the station at Hamilton, Ravalli County. The quarter corner between secs. 25 and 30, Rs. 20 and 21 W., T. 6 N., is distant 339 feet, true bearing N. $39^{\circ} 13' W.$

Observations for time were made on three nights in July, 1897. Telegraphic comparisons of time were made with the Washington Observatory, St. Louis, on the same nights. Prof. H. S. Pritchett was the observer at the Washington Observatory and Mr. S. S. Gannett at the Hamilton station.

The resulting observed longitude for the Hamilton station is $114^{\circ} 09' 09.40'' \pm 0.11''$.

The observed latitude from 56 sets of observations is $46^{\circ} 14' 53.91''$
 $\pm 0.11''$.

To obtain the geodetic positions adopted, add to the above $1.57''$
 for latitude and $2.13''$ for longitude.

A meridian mark was set 2,377 feet south of pier on the section
 line, 213.4 feet east of corner between secs. 31, 36, 25, and 30, T. 6 N.,
 R. 20 W.

The Bitterroot Base was measured with 300-foot steel tape along
 the Hamilton branch of the Northern Pacific Railway.

The resulting length, when reduced to sea level and corrected for
 temperature and inclination, is 8,582.835 meters.

Connection was made with post No. 373 on the international boundary
 and with a station of the Missouri River Commission (see Hilger
 station below).

Azimuths were obtained by observations on Polaris near elongation
 at following stations: Hamilton (astronomic station), Helena West
 Base, Monture, Carey, and Durham.

MONTURE, DEER LODGE COUNTY.

A high, sharp peak on southern end of an approximately north-and-south ridge between two streams flowing into South Fork of Flathead River. The westermost branch of Monture Creek heads immediately south of station. Peak is about 12 miles north from Woodworth post-office and 20 miles northwest of Ovando post-office. The best approach is from Woodworth via trail up East Fork of Shanley (or Cottonwood) Creek, across east-and-west ridge to headwaters of Monture Creek, through pass southeast of station. Animals were taken to summit. Good camps at lakes on high shelf east of station.

Station mark: An aluminum bolt set in a boulder weighing several tons.

[Latitude $47^{\circ} 14' 28.41''$. Longitude $113^{\circ} 17' 37.23''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Kamas	26 40 08.07	206 25 57.27	4.7399916
McLeod	71 46 10.73	251 18 33.13	4.7006137
McDonald	109 01 24.01	288 33 51.54	4.6979308
Holland	146 46 33.27	326 33 51.64	4.5966669
Gordon	191 21 35.48	11 23 59.42	4.3187096
Scapegoat	257 05 13.29	77 25 45.73	4.5581578
Stonewall	287 33 59.67	107 58 28.19	4.6461419

ÆNEAS, FLATHEAD COUNTY.

A high, bare, rocky peak on Swan Range, about 1 mile south of Æneas Pass trail, 10 miles north of foot of Swan Lake, 5 miles east of south end of Echo Lake. Easiest reached from the west by Æneas Pass, thence south along ridge. Good camp at small lake one-half mile south and 500 feet below station, at foot of Æneas trail.

Station mark: An aluminum tablet cemented in rock in place, above which a cairn 7 feet high was erected.

[Latitude $48^{\circ} 09' 00.18''$. Longitude $113^{\circ} 55' 05.28''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Moss.....	4 17 54.69	184 15 36.68	4.7138082
G. N.....	206 51 28.55	26 57 50.35	4.3679815
Baptiste.....	276 02 37.98	96 15 23.15	4.3296589
Gildart.....	330 57 57.43	151 09 15.48	4.5920903

BAPTISTE, FLATHEAD COUNTY.

A high, bare, sandstone peak, light in color, and highest in vicinity, on range east of South Fork of Flathead River, about 10 miles southwest from Java Station on Great Northern Railway. It was ascended by traveling about 4 miles on foot along ridge from the south. There is a good camp in basin at head of gulch flowing to South Fork, about 1 mile southwest of station, from which the climb to station is not difficult.

Station mark: An aluminum tablet cemented in rock in place, over which a cairn 6 feet high was erected.

[Latitude $48^{\circ} 07' 46.08''$. Longitude $113^{\circ} 37' 57.90''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Swan.....	0 42 26.09	180 42 06.12	4.6572513
Gildart.....	4 16 52.85	184 15 27.46	4.5052975
Moss.....	27 11 38.65	206 56 38.27	4.7432742
Æneas.....	96 15 23.15	276 02 37.98	4.3296589
G. N.....	155 19 00.86	335 12 36.92	4.4052811
Stimpson.....	182 20 13.96	2 21 17.88	4.6335816
Observation.....	211 26 50.30	31 40 33.62	4.6377352
Elk.....	235 00 57.26	55 15 59.88	4.4837563
Half Dome.....	248 41 47.27	69 06 34.17	4.6448796
Pentagon.....	300 12 30.27	120 35 18.88	4.6439957
Silvertip.....	323 01 05.26	143 18 08.99	4.6785024

COALBANK, FLATHEAD COUNTY.

About 20 miles almost due north of Columbia Falls, on highest point of ridge, 1 mile east of North Fork of Flathead River, 3 miles south of mouth of Camas Creek, and 5 miles southeast and across river from mouth of Coal Creek. Easily ascended from north, where good camp may be found about 4 miles northeast of station. From Camas Creek keep southwesterly through timber and windfall to a long, timbered ridge, a north spur from which peak is visible.

Station mark: An aluminum tablet cemented in block of limestone 36 by 18 by 16 inches resting on surface, with small cairn 2 feet high over it.

Reference mark: A cairn 6 feet high, around which is tripod 15 feet high, 4.7 feet west of center.

[Latitude $48^{\circ} 36' 08.06''$. Longitude $114^{\circ} 07' 58.98''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Vulture.....	197 06 43.77	17 11 42.70	4.4403850
Heavens.....	239 33 31.95	59 46 03.41	4.3758830

GILDART, FLATHEAD COUNTY.

A high, rocky, shale point on summit of Swan Range, about 10 miles northwest of Swan Peak, about 12 miles southwest of south end of Swan Lake, 10 miles northeast of Squaw Flat. Good camping place at a small lake one-fourth mile south and 500 feet below station.

Station mark: An aluminum bolt set in shale rock, over which a cairn 6 feet high was erected.

[Latitude $47^{\circ} 50' 32.54''$. Longitude $113^{\circ} 39' 52.83''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Moss.....	52 52 45.61	232 39 12.36	4.4583161
Æneas.....	151 09 15.48	330 57 57.43	4.5720903
Baptiste.....	184 15 27.46	4 16 52.85	4.5052975
Pentagon.....	256 25 17.57	76 49 23.37	4.6193167
Silvertip.....	281 13 25.03	101 31 51.59	4.5009454

G. N., FLATHEAD COUNTY.

On the highest and most northwesterly of group of high, bare, rocky peaks of a brilliant yellow color in sunlight, between Great Northern Railway and South Fork of Flathead River, about 15 miles south

of west from Paola, about 15 miles due south from Nyack. The south slope is a cliff and the north and northeast slopes are covered by a glacier. Ascent was made from camps at two small lakes southeast of station.

Station mark: A copper nail in mound of cement and rock chips, over which a cairn 6 feet high was erected.

[Latitude $48^{\circ} 20' 13.74''$. Longitude $118^{\circ} 46' 38.47''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Æneas	26 57 50.35	206 51 28.55	4.3679315
Stimpson	211 47 53.12	81 55 22.82	4.3693805
Half Dome	277 40 01.70	98 11 16.00	4.7178889
Baptiste	335 12 36.82	155 19 00.86	4.4052811

HEAVENS, FLATHEAD COUNTY.

The highest sharp peak on ridge between McDonald Creek and Camas Creek, having a glacier on north and heavy snow field on east, about 5 miles north of northern end of McDonald Lake. It may be ascended from McDonald Creek by a long, hard climb, but the easiest route is from Camas Creek west of station by trail up Camas Creek to point about halfway between marshy meadow and first lake above Trout Lake, thence east up small stream heading in basin directly west of station, thence up spur north of basin to summit. Rock wall climbing for 2,000 feet.

Station mark: A bronze triangulation tablet cemented in solid rock on edge of cliff.

Reference mark: A cairn 6 feet high 3 feet southwest of station mark.

[Latitude $48^{\circ} 42' 36.15''$. Longitude $113^{\circ} 51' 18.05''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Coal bank	59 46 03.41	239 33 31.95	4.3753830
Vulture	139 25 55.88	319 18 22.24	4.2767308
Cleveland	181 27 22.63	1 27 45.27	4.38820563
Chief	215 53 50.41	36 04 59.30	4.4892290
Siyeh	261 27 08.56	81 36 27.41	4.1866002

MOSS, FLATHEAD COUNTY.

On a high, rocky peak on Mission Range, 4,500 feet above Flathead Lake, about 4 miles east of Phil. Moss's house. Small timber on top of

mountain was practically cleared off. Easily ascended by trail turning east up ridge, about a mile north of Moss's house. Good camp near foot of cliff to east and 1,000 feet below station; if no water there, find small meadow and pond 1½ miles northeast, or lake 1½ miles southeast.

Station mark: An aluminum tablet cemented in limestone ledge.

[Latitude 47° 41' 09.71". Longitude 113° 58' 11.22".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Æneas	184 15 36.68	4 17 54.69	4.7138082
Baptiste	206 56 38.27	27 11 38.65	4.7432742
Gildart	232 39 12.36	52 52 45.61	4.4583161
Swan	260 56 43.68	81 11 21.24	4.3986100
Holland	299 27 42.68	119 44 55.97	4.5264182
McDonald	353 23 19.41	178 24 36.47	4.5284824

STIMPSON, FLATHEAD COUNTY.

The highest prominent mountain about 10 miles, air line, northeast of Nyack station, Great Northern Railway, 6 miles southwest of Cut Bank Pass.

Station mark: A bronze triangulation tablet cemented in solid rock, above which a cairn 6 feet high was erected.

[Latitude 48° 30' 57.41". Longitude 113° 36' 32.43".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Baptiste	2 21 17.88	182 20 13.96	4.6335816
Siyeh	173 02 48.84	353 01 46.16	4.3805672
Divide	222 29 55.14	42 40 04.16	4.3582004
Observation	285 51 16.29	106 03 58.03	4.3369737
Elk	317 43 41.50	137 57 42.89	4.5876220

SWAN, FLATHEAD COUNTY.

The highest sharp peak of the Swan Range lying between the Swan Valley and the valley of the South Fork of Flathead River. The peak is easily ascended by following the northeast ridge from camp at foot of cliff due east from station.

Station mark: A bronze triangulation tablet cemented in solid rock, above which a cairn 7 feet high was erected.

[Latitude $47^{\circ} 43' 15.595''$. Longitude $113^{\circ} 38' 24.80''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
McDonald	29 18 20.25	209 06 01.90	4.6322527
Moss	81 11 21.24	260 56 43.68	4.3986100
Baptiste	180 42 06.12	0 42 26.09	4.6572513
Silvertip	255 57 25.72	76 14 46.05	4.4793510
Holland	347 45 20.68	167 47 57.74	4.3214981

VULTURE, FLATHEAD COUNTY.

A high, ragged peak with glacier remnants on east, on ridge dividing waters of Little Kootenai Creek and the North Fork of Flathead River. It is between the head of Quartz Creek on north and Logging Creek on south. Most easily ascended from near the head of Little Kootenai Creek via trail to summit of ridge one-half mile north of large cairn on prominent peak, thence southwesterly around head of Quartz Creek across bench due east of peak, thence over snow field and through gap just south of station, thence north across snow field to top of ridge, thence along crest to station.

Station mark: A bronze triangulation tablet under center of cairn 8 feet high.

[Latitude $48^{\circ} 50' 20.78''$. Longitude $114^{\circ} 01' 21.20''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Coal bank	17 11 42.70	197 06 43.77	4.4408850
Cleveland	232 52 39.49	53 00 36.56	4.2086134
Siyeh	298 35 42.22	113 52 35.32	4.4776027
Heavens	319 18 22.24	189 25 55.88	4.2767308

QUIGG, GRANITE COUNTY.

A high, rocky peak, about 20 miles south of Quigley and about 3 miles east of Rock Creek at point where trail to Stevensville, via Burnt Fork, leaves main Quigley-Phillipsburg trail. Peak is about 4,100 feet above river, and the slopes are covered with small scattering trees. About 2 miles east of station is a similar peak, bare, and perhaps higher.

Station mark: An aluminum tablet cemented in ledge, close to edge of precipice north of station.

Reference marks: Copper nail in notch on west side of pine tree, blazed on northeast and west sides (S); true azimuth, $352^{\circ} 48'$; distance, 53.4 feet south. Copper nail in top of pine stub blazed on

north, south, east, and west sides; true azimuth, $128^{\circ} 21'$; distance, 27.2 feet west. Copper nail in turn of pine stub blazed on side toward station; true azimuth, $267^{\circ} 55'$; distance 24 feet east.

[Latitude $46^{\circ} 29' 01.36''$. Longitude $113^{\circ} 43' 04.32''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Willow	° ' "	° ' "	<i>Meters.</i>
	41 12 36.54	221 03 41.08	4.3803840
St. Mary	94 50 59.47	274 28 07.87	4.6069916
Miller	157 16 02.01	337 08 42.48	4.5212790
McLeod	167 13 20.58	347 04 26.19	4.8445761
Kamas	192 28 26.79	12 32 51.52	4.5582809

CAREY, LEWIS AND CLARKE COUNTY.

Station is in NW. $\frac{1}{4}$ of sec. 11, T. 20 N., R. 7 W., on north end of flat, grassy ridge running northeasterly and southwesterly, about 5 miles northwest of town of Augusta. It is about one-half mile south of road from Augusta to Sun River Canyon (North Fork), and about 4 miles southeast of "China" Clark's ranch on Willow Creek. Azimuth station.

Station mark: Copper bolt set in rock in place, marked "U. S. G. S. Δ ."

[Latitude $47^{\circ} 30' 24.76''$. Longitude $112^{\circ} 27' 14.31''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Dearborn	° ' "	° ' "	<i>Meters.</i>
	17 53 06.65	197 48 35.17	4.4019801
Scapegoat	52 32 36.20	232 16 05.76	4.5513954
Fairview	83 37 46.40	263 24 42.84	4.3500521
Rocky	142 55 47.19	322 40 29.10	4.6321238

CLIFF, ON LINE BETWEEN LEWIS AND CLARKE AND DEER LODGE COUNTIES.

On Continental Divide, on edge of cliff, about 15 miles north of west of Warm Springs on North Fork of Sun River, at head of West Fork of South Fork of North Fork of Sun River, and about $6\frac{1}{2}$ miles nearly west of "Whiteridge." There is a break in cliff wall about 2 miles north of station and a goat trail over break. Best route to foot of cliff is via North Fork of Sun River and up the first canyon north of Whiteridge station.

Station mark: A copper bolt set in solid rock.

Reference mark: A cairn 6 feet high, 7.5 feet north of station mark.

[Latitude $47^{\circ} 39' 30.51''$. Longitude $113^{\circ} 07' 39.69''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Silvertip	° ' "	° ' "	<i>Meters.</i>
Silvertip	147 11 49.77	327 06 24.40	4.2277913
Pentagon	180 37 39.81	0 37 51.06	4.4782543
Rocky	234 50 07.95	55 04 43.69	4.4787721
Whiteridge	258 08 36.32	78 14 12.69	3.9867018
Scapegoat	329 30 27.07	149 43 43.23	4.6504064

DEARBORN, LEWIS AND CLARKE COUNTY.

The highest point of eastern end of a long ridge dividing the waters of the North Fork of Dearborn River (to south) from the South Fork of Sun River (to north). The mountain has high cliffs of white limestone on east, south, and north, but the southwest slope is comparatively gradual. About 4 miles south of west of Sheep Mountain.

Best ascended from camp on Dearborn River, southwest of peak. Pack animals can be taken to station.

Station mark: A copper bolt marked "U. S. G. S. Δ " set in rock in place, about 10 feet from edge of cliff.

[Latitude $47^{\circ} 17' 27.01''$. Longitude $112^{\circ} 33' 23.12''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Stonewall	° ' "	° ' "	<i>Meters.</i>
Stonewall	35 38 11.10	215 30 12.74	4.8726424
Scapegoat	96 30 25.26	276 18 27.59	4.3147674
Fairview	145 57 39.49	325 49 08.70	4.4142805
Carey	197 48 35.17	17 58 06.65	4.4019801
Mitchell	328 30 21.50	148 42 31.19	4.6050259
Nevada	359 01 21.40	179 01 55.27	4.7608965

EAST BASE, LEWIS AND CLARKE COUNTY.

On top of bank north of Northern Pacific Railway track, at first cut, about 1 mile west of East Helena station.

Station mark: A bronze bench-mark tablet set in a dressed granite block, 27.5 feet north of the north rail of track and about 12 feet above it.

[Latitude $46^{\circ} 35' 32.01''$. Longitude $111^{\circ} 56' 24.85''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Lenox.....	° ' "	° ' "	<i>Meters.</i>
	56 56 18.10	236 52 41.29	3.8801431
Court-House	86 06 51.67	266 02 44.33	3.8612164
Mount Helena.....	88 17 28.38	268 11 59.17	3.9779385
West base.....	101 05 27.93	281 01 49.78	3.8136990
Scratchgravel	181 08 54.47	311 02 39.88	4.1626492
Gamer.....	184 51 38.90	344 49 56.69	4.0583098
Hilger.....	181 57 34.93	1 57 58.36	4.3006694

WEST BASE, LEWIS AND CLARKE COUNTY.

About 570 feet west of switch stand near western end of tangent of Northern Pacific Railway track and 1,900 feet west of the depot at Helena. It is 27.5 feet north of the line of the north rail of main track projected from end of tangent, and is south of track. Center is 67.5 feet from switch stand, on north side of track, to northeast and 70.35 feet from switch stand, on south side of track to northwest.

Station mark: A bronze bench-mark tablet set in a dressed granite block.

[Latitude $46^{\circ} 36' 12.47''$. Longitude $112^{\circ} 01' 24.60''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Court-house spire.....	° ' "	° ' "	<i>Meters.</i>
	26 07 08.51	206 06 39.30	3.2887750
Mount Helena.....	63 39 09.67	243 37 23.58	3.5402121
Scratchgravel	151 11 59.58	331 09 23.26	3.9770434
Gamer.....	199 06 45.92	19 08 42.03	4.0154497
East base.....	281 01 49.78	101 05 27.93	3.8136990
Lenox.....	359 36 53.99	179 36 55.22	3.7317875

FAIRVIEW, LEWIS AND CLARKE COUNTY.

About 16 miles a little south of west of town of Augusta, on the highest point of high ridge just west of a head of a North Fork of Willow Creek (which flows to the North Fork of Sun River), and about 1 mile north of the main branch of Willow Creek. It is about 2 miles west of "Red" McCarty's ranch house. The Augusta-Warm Springs road, via Willow Creek, passes east of station, and wood roads lead to foot of cliff beneath it.

Station mark: A copper bolt set in rock in place, 7.6 feet west of cairn.

110 PRIMARY TRIANGULATION AND PRIMARY TRAVERSE. [BULL. 201.

Reference mark: A cairn 8 feet high, erected 5 feet from edge of cliff.

[Latitude $47^{\circ} 29' 02.95''$. Longitude $112^{\circ} 44' 57.17''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Scapegoat	° ' "	° ' "	<i>Meters.</i>
	17 10 48.89	197 07 20.51	4.3028101
Whiteridge	138 30 03.82	318 18 53.87	4.4558891
Rocky	174 11 44.97	354 09 32.49	4.5665888
Carey	268 24 42.84	88 37 46.40	4.3500521
Dearborn	325 49 08.70	145 57 39.49	4.4142805

GAMER, LEWIS AND CLARKE COUNTY.

The station is just south of the middle of an east-west road running on second section line north of south line of T. 11 N., R. 3 W., about one-fourth mile east of Fred Gamer's ranch house, about 8 miles north and east of Helena, and 443 feet west of stone in swamp, marking corner common to secs. 21, 22, 27, and 28, T. 11 N., R. 3 W.

Station mark: A copper bolt stamped "U.S.G.S. Δ ", set in a granite post about 12 by 10 by 6 inches and level with surface of ground, having a mound of earth about 12 inches high heaped over the center.

[Latitude $46^{\circ} 41' 29.52''$. Longitude $111^{\circ} 58' 44.98''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
West base	° ' "	° ' "	<i>Meters.</i>
	19 08 42.03	199 06 45.92	4.0154497
Scratchgravel	79 30 32.88	259 26 00.29	3.9084088
Hilger	202 18 38.59	22 20 44.40	3.9848157
SE. cor. secs. 21, 22, 27, and 28, T. 11 N., R. 3 W.			2.1308116
East base	344 49 56.69	164 51 38.90	4.0588098

HILGER, LEWIS AND CLARKE COUNTY.

A station of the Missouri River Commission Survey, on the eastern end of a flat-topped mountain about $2\frac{1}{2}$ miles west of Missouri River, 15 miles northwest of Helena, and 22 miles northwest of Canyon Ferry on Missouri River.

Station mark: A $\frac{1}{4}$ -inch copper bolt, leaded into rock in place, set by Missouri River Commission.

[Latitude $46^{\circ} 46' 18.78''$. Longitude $111^{\circ} 55' 52.15''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
East base	1 57 58.36	181 57 48.98	4.3006695
Lenox	16 17 22.88	196 13 22.30	4.4000026
Gamer	22 20 44.40	202 18 38.59	3.9848157
Red	33 02 05.53	212 49 24.67	4.6125363
Scratchgravel	48 12 22.20	228 05 43.65	4.1983062
Nevada	90 21 45.41	269 54 59.04	4.6700058
Mitchell	131 22 47.89	311 07 31.60	4.5485050

Position for this station, as published by the Missouri River Commission in Appendix AAA, Report for 1891 of Chief of Engineers, War Department:

Latitude, $46^{\circ} 46' 10.07''$. Longitude, $111^{\circ} 55' 48.43''$.

LENOX, LEWIS AND CLARKE COUNTY.

The station is on a high, grassy ridge, 2.4 miles south of the courthouse at Helena, and 2.25 miles west of south of the Lenox addition to the city of Helena.

Station mark: A bronze bench-mark tablet cemented in rock in place.

[Latitude $46^{\circ} 33' 17.83''$. Longitude $112^{\circ} 01' 22.90''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Red	56 07 20.15	235 58 40.62	4.2649438
Nevada	121 29 50.10	301 07 07.16	4.6686244
Helena	140 46 34.00	320 44 46.71	3.6966486
West base	179 36 55.22	359 36 53.99	3.7317875
Hilger	196 13 22.30	16 17 22.88	4.4000026
East base	236 52 41.29	56 56 18.10	3.8801431

MITCHELL, LEWIS AND CLARKE COUNTY.

On north peak of a high, grassy ridge, bare on north and west slopes, with scattering timber on the south and dense forest on east slope; about 10 miles northwest of Mitchell station on Montana Central Railway and immediately west of Lyon Gulch. It is between the waters of Lyon Gulch and Canyon Creek, and about $2\frac{1}{2}$ miles east of the Continental Divide.

Station mark: A copper bolt marked U. S. G. S. Δ set in rock in place.

112 PRIMARY TRIANGULATION AND PRIMARY TRAVERSE. [BULL. 20].

[Latitude $46^{\circ} 58' 58.82''$. Longitude $112^{\circ} 16' 47.53''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Nevada	° ' "	° ' "	<i>Meters.</i>
Stonewall	40 59 57.79	220 48 24.96	4.4870990
Scapegoat	113 46 08.85	298 26 03.02	4.5791777
Dearborn	131 38 20.00	311 14 35.51	4.7436966
Hilger	148 42 31.19	328 30 21.50	4.6050259
Scratchgravel	311 07 31.60	131 22 47.89	4.5485050
	335 56 46.55	156 05 22.86	4.5671950

MOUNT HELENA, LEWIS AND CLARKE COUNTY.

Station is on summit of high peak a mile west of the city of Helena.

Station mark: A bronze bench-mark tablet cemented in rock in place, stamped 5458 feet.

[Latitude $46^{\circ} 35' 22.58''$. Longitude $112^{\circ} 03' 50.63''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
West Base	° ' "	° ' "	<i>Meters.</i>
East Base	243 37 23.58	63 39 09.67	3.5402121
Lenox	268 11 59.17	88 17 28.38	3.9779985

PENTAGON, ON LINE BETWEEN LEWIS AND CLARKE AND DEER LODGE COUNTIES.

A high peak on Continental Divide, approximately 25 miles (air line) southwest of Raymond post-office. The drainage on the north, west, and south is to the Middle Fork of Flathead River; that to the southeast is to North Fork of Sun River. The base of the peak has somewhat the shape of a pentagon, whence the name. Southeast of peak is a small lake and feed where good camp is afforded. From here the ascent is comparatively easy, a climb of about 2,000 feet.

Station mark: A copper bolt set in solid rock.

Reference mark: A cairn 7 feet high, 12.3 feet north of station mark.

[Latitude $47^{\circ} 55' 44.33''$. Longitude $113^{\circ} 07' 28.82''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Cliff	° ' "	° ' "	<i>Meters.</i>
Silvertip	0 37 51.06	180 37 39.31	4.4782548
Gildart	30 51 22.22	210 45 44.39	4.2669682
Baptiste	76 49 23.37	256 25 17.58	4.6198167
Elk	120 35 13.88	300 12 30.27	4.6439057
Half Dome	162 04 08.01	341 56 23.98	4.6206030
Rocky	184 57 09.25	4 59 08.68	4.5834950
	297 40 04.06	117 54 29.90	4.4381328

SCAPEGOAT, ON LINE BETWEEN LEWIS AND CLARKE AND DEER
LODGE COUNTIES.

Highest point of ragged limestone peak on Continental Divide, at head of a West Branch of the North Fork of Dearborn River. The drainage to southwest is to Blackfoot River; to northwest is to Flathead River. The point has low cliff on southwest. It rises from a plateau which is surrounded by a cliff with vertical wall of 500 feet and total height of about 1,000 feet. Ascended from east, from a West Branch of the North Fork of Dearborn River. Cliff may be scaled by ascent of snow in reentrant angle, about $1\frac{1}{2}$ miles southwest of point, or over tongue of ridge 2 miles southwest of point.

Station mark: A copper bolt 10.5 feet east of cairn and about 3 feet below it, marked "U. S. G. S. Δ ."

Reference mark: A cairn 6 feet high on highest point.

[Latitude $47^{\circ} 18' 41.60''$. Longitude $112^{\circ} 49' 39.58''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Gordon	111 58 02.86	291 39 52.11	4.5249427
Fairview	197 07 20.51	17 10 48.39	4.3028101
Carey	232 16 05.76	52 32 36.20	4.5513954
Dearborn	276 18 27.59	96 30 25.26	4.3147674
Mitchell	311 14 35.51	181 38 20.00	4.7436966
Stonewall	342 19 51.98	162 23 50.24	4.3530878

SCRATCHGRAVEL, LEWIS AND CLARKE COUNTY.

Station is on highest point of a rocky knoll about 8 miles a little west of north from the city of Helena. Summit is thickly timbered, but some cutting was done near station.

Station mark: A copper rivet set in lead in rock in place.

Reference mark: A nail at bottom of blaze on south side of pine tree northeast of station; true azimuth to nail, $236^{\circ} 21'$; distance, 12.25 feet.

[Latitude $46^{\circ} 40' 41.59''$. Longitude $112^{\circ} 04' 59.60''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Mitchell	156 05 22.86	335 56 46.55	4.5671950
Hilger	228 05 43.65	48 12 22.20	4.1933062
Gamer	259 26 00.27	79 30 32.88	3.9084088
East Base	311 02 39.88	131 08 54.47	4.1626492
West Base	381 09 28.26	151 11 59.58	3.9770434

WHITERIDGE, LEWIS AND CLARKE COUNTY.

The highest peak on White Ridge, lying approximately northeast and southwest, about 10 miles northwest of the Warm Springs on the North Fork of Sun River. It is easily ascended via the northeast spur.

Station mark: A copper bolt marked "U.S.G.S.▲" set in hard stone, extending 6 inches above surface and 18 inches below it.

Reference mark: A cairn 9 feet high 7.5 feet east of center.

[Latitude 47° 40' 34.78". Longitude 113° 00' 04.67".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Cliff	° ' " 78 14 12.69	° ' " 258 08 36.32	3.9867018
Silvertip	123 18 41.25	303 07 39.14	4.3480500
Rocky	224 40 21.14	44 49 20.21	4.3334810
Fairview	318 18 53.87	188 30 03.82	4.4558891
Scapegoat	342 03 17.29	162 10 58.11	4.6295499

GORDON, ON LINE BETWEEN MISSOULA AND POWELL COUNTIES.

On the bare rocky summit of a comparatively low mountain 5 miles southwest of junction of South Fork of Flathead River and Willow Creek. The top is light-colored limestone dipping northeast, at northern end of a long timbered ridge.

Station mark: An aluminum tablet cemented in a flat rock.

Reference marks: + cut in rock north of station, 21.8 feet distant. + cut in rock west of station, 28.7 feet distant.

[Latitude 47° 25' 24.63". Longitude 113° 14' 21.48".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Monture	° ' " 11 23 59.42	° ' " 191 21 35.48	4.3187098
Holland	116 09 36.42	295 54 29.38	4.4575508
Scapegoat	291 39 52.11	111 58 02.36	4.5249680
Stonewall	311 36 01.52	131 58 08.34	4.7069408

HOLLAND, MISSOULA COUNTY.

A very high, sharp, bare peak on Swan Range, about 8 miles northeast of Holland ranch, in Swan Valley, and 6 miles west of north from Gordon Pass. May be approached with animals from Gordon Pass by keeping on high shelf, swinging around amphitheaters east of crest, crossing crest in pass, thence following game trail about 2 miles south.

of station, and then traveling along ridge to station. Water, wood, and grass in flat west of crest and about 2 miles from station.

Station mark: A bronze triangulation tablet cemented under center of cairn 8 feet high.

[Latitude 47° 32' 12.17". Longitude 118° 34' 52.13".]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
McLeod	27 53 02.63	207 38 01.81	4.7424174
McDonald	56 26 16.18	236 11 22.28	4.4848600
Moss	119 44 55.97	299 27 42.68	4.5264132
Swan	167 47 57.74	347 45 20.68	4.3214980
Silvertip	221 46 56.48	42 01 38.15	4.5712744
Gordon	295 54 29.38	116 09 36.42	4.4575503
Monture	326 33 51.64	146 46 33.27	4.5966669

KAMAS, MISSOULA COUNTY.

On highest point and at east end of a high, timbered ridge on divide between waters of Big Blackfoot and Hellgate rivers. About 7 miles due south of Potomac post-office, Kamas Prairie, and about 6 miles east of Clinton, station of Northern Pacific Railway. It is about 2 miles southeast from point where road from Clinton to Potomac crosses divide.

Station mark: An aluminum tablet cemented in a stone buried even with surface of ground.

Reference marks: Copper nail in notch on pine tree 24 inches diameter, 50.75 feet west; copper nail in top of fir stump 10 inches diameter, 21 feet north; copper nail in top of pine stump, blazed, 13.2 feet northeast.

[Latitude 46° 47' 51.64". Longitude 118° 37' 00.20".]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Quigg	12 32 51.52	192 28 26.79	4.5532809
St. Mary	56 49 45.87	236 22 25.90	4.7591661
McLeod	145 12 31.92	324 59 10.07	4.6081045
Monture	206 25 57.27	26 40 08.07	4.7399916
Stonewall	241 38 22.85	62 16 54.23	4.8798203

M'DONALD, MISSOULA COUNTY.

The highest peak of the Mission Range, about 15 miles north of east from St. Ignatius Mission and 20 miles north of Flathead Agency.

Top of mountain has two summits of equal elevation about $\frac{1}{2}$ mile apart with drop of perhaps 100 feet between. Station is on eastern peak. The mountain is more easily approached from the Flat Valley than from Swan Valley and is most easily ascended from southwest. There is little feed for stock, but wood and water plentiful on McDonald Creek at east foot of peak.

Station mark: An aluminum bolt cemented in spit rock in center of a cairn 9 feet high.

[Latitude $47^{\circ} 23' 08.64''$. Longitude $113^{\circ} 55' 05.42''$.]

To station—	Azimuth.	Back azimuth.	Log. dist.
McLeod.....	00 27 46.86	180 27 37.90	4.50
Moss.....	173 24 36.48	353 22 19.41	4.52
Swan.....	209 06 01.90	29 18 20.25	4.63
Holland.....	236 11 22.28	56 26 16.18	4.48
Monture.....	288 33 51.54	109 01 24.01	4.69

M'LEOD, MISSOULA COUNTY.

The highest peak of group of mountains lying south of Jocko River and north of Missoula, on a southern extension of the Mission Range. It is plainly visible from Jocko post-office and Jocko Valley. Sun is round and barren, broken rock, having a deep amphitheater to the northeast. Peak is easily ascended on foot, from pass on north 800 feet below summit, but animals may be taken to the station approaching the peak from the southern slope.

Station mark: An aluminum tablet, cemented in rock in place, which is a cairn 9 feet high.

[Latitude $47^{\circ} 05' 48.80''$. Longitude $113^{\circ} 55' 17.53''$.]

To station—	Azimuth.	Back azimuth.	Log. dist.
St. Mary.....	20 50 35.53	200 36 31.51	4.84
McDonald.....	180 27 37.90	0 27 37.60	4.50
Holland.....	207 38 01.81	27 58 02.63	4.74
Monture.....	251 18 33.13	71 46 10.73	4.70
Kamas.....	324 59 10.07	145 12 31.92	4.60
Quigg.....	347 04 26.19	167 13 20.58	4.84
Miller.....	355 50 47.28	175 52 21.13	4.57

MILLER (MILLER CREEK PEAK), MISSOULA COUNTY.

On a high, round-topped knob, about 10 miles (air line) south of Missoula. Knob is timbered on top, on north, east, and

slopes; is grassy and open on south. It is between Little Park Creek, a branch of Miller Creek, and main Miller Creek; about 2 miles northeast of Hayes's sawmill and 2 miles southeast of mouth of Little Park Creek. Good camp on Miller Creek.

Station mark: An aluminum tablet cemented in solid rock.

[Latitude $46^{\circ} 45' 32.90''$. Longitude $113^{\circ} 53' 09.05''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Willow	° ' "	° ' "	<i>Meters.</i>
Willow	3 23 06.95	183 21 29.21	4.6882822
St. Mary	45 09 31.98	224 53 56.85	4.5878858
McLeod	175 52 21.13	255 50 47.28	4.5757137
Quigg	337 08 42.48	157 16 02.01	4.5212790

DALY, RAVALLI COUNTY.

A station used only in the expansion of the base, situated 6 miles east of Hamilton, on land owned by Marcus Daly estate. It is on a rounded bald knob about 1,000 feet above the valley, and would be of no use in extending triangulation eastward, as much higher points are back of it.

Station mark: A bronze tablet set in shale rock.

[Latitude $46^{\circ} 14' 02.78''$. Longitude $114^{\circ} 01' 14.16''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
South base	° ' "	° ' "	<i>Meters.</i>
South base	68 44 55.92	248 39 27.36	4.0199315
Ward (2)	71 02 12.83	250 50 47.11	4.3384344
Ward (1)	71 23 34.32	251 12 13.86	4.3291730
North base	114 19 16.11	294 13 21.18	4.0623393
St. Mary	151 11 32.72	381 01 52.82	4.5495169
Willow	217 47 48.75	87 52 02.00	4.0875631

EL CAPITAN, RAVALLI COUNTY.

The station is on the central chimney of the main peak. It can be reached by going up the main fork of Rock Creek about 12 miles from Lake Como, to a point where a creek comes in from the south over a series of falls about 200 feet high. Proceed upstream about 200 yards above this point to a point where a blazed trail comes in from the south, crossing Rock Creek about 200 yards above the falls. A trail was cut and blazed up the South Fork of Rock Creek to an elevation of over 6,000 feet.

Station mark: A copper bolt in solid rock.

[Latitude 46° 00' 32.91". Longitude 114° 23' 44.55".]

To station—	Azimuth.	Back azimuth.	Log. distance.
St. Mary	191 48 04.3	11 54 41.1	4.757832
Ward (2)	205 33 19.6	25 37 08.0	4.299310
Willow	226 17 46.1	46 38 18.0	4.701860

NORTH BASE, RAVALLI COUNTY.

Two miles north of Hamilton, on prolongation of the railroad tangent, opposite the sawmill at Riverside and 19.5 feet south of a fence running east and west.

Station mark: A bronze tablet cemented in a rock set flush with surface of ground.

Reference marks: Crosses cut on rocks set respectively 10 feet north, east, and west of the station.

[Latitude 46° 16' 36.46". Longitude 114° 09' 25.46".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Ward (1)	39 54 25.84	219 48 59.87	4.1788528
St. Mary	165 53 52.84	345 50 08.51	4.4330820
Willow	254 38 55.30	74 49 08.84	4.2712508
Daly	294 13 21.18	114 19 16.11	4.0628398
South base	354 48 43.70	174 49 09.85	3.9336308
Astronomic pier	354 32 02.44	174 32 12.50	3.4958579

ST. MARY, RAVALLI COUNTY.

Eight miles west of Stevensville. To reach the station, go to Curlew extension, north end of Curlew mine, and follow the ridge nearly to the top, then turn off on right-hand ridge and follow it to main dividing ridge, along which a trail is plainly blazed to the lake, which is about $1\frac{1}{2}$ miles north of station and 8 miles northwest of Curlew.

Station mark: A copper bolt in solid rock, above which a cairn 8 feet in diameter and 10 feet high was erected.

[Latitude $46^{\circ} 30' 47.79''$. Longitude $114^{\circ} 14' 35.27''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	Meters.
Ward (1)	4 35 14.87	184 33 32.40	4.5797243
Ward (2)	4 47 49.15	184 46 01.41	4.5820774
El Capitan	11 54 41.10	191 48 04.30	4.7578320
Willow	310 52 19.34	131 06 13.50	4.5129510
Daly	331 01 52.82	151 11 32.72	4.5495169
North base	345 50 08.51	165 53 52.84	4.4330820
South base	347 58 33.55	168 02 43.96	4.5515850

SOUTH BASE, RAVALLI COUNTY.

One-third of a mile south of the railroad station at Grantsdale, on prolongation of railroad tangent and about 500 feet south of its extremity. The station is on slightly elevated ground just west of an irrigation ditch.

Station mark: A copper bolt 1 inch in diameter sunk $3\frac{1}{2}$ inches in a rock 8 inches square on top, set 3 feet in the ground.

Reference mark: A cross cut in the top of a rock 10 feet westward and at right angles to the base line.

[Latitude $46^{\circ} 11' 59.62''$. Longitude $114^{\circ} 08' 49.25''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	Meters.
Ward (1)	73 50 35.38	253 44 43.50	4.0370748
St. Mary	168 02 43.96	347 58 33.55	4.5515850
North base	174 49 09.85	354 48 43.70	3.9336308
Willow	231 56 56.56	52 06 38.56	4.3401538
Daly	248 39 27.36	68 44 55.92	4.0199315

WARD (1), RAVALLI COUNTY.

Six miles, air line, southwest of Grantsdale. The station is on the northern end, but about 100 feet lower than the highest point, of the high mountain just north of Roaring Lion Creek. The summit extends northeast and southwest about one-fourth mile.

Station mark: A copper bolt in the solid rock, above which a cairn 5 feet in diameter at base and 10 feet in height was erected.

[Latitude $46^{\circ} 10' 21.18''$. Longitude $114^{\circ} 16' 56.91''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
St. Mary	184 33 32.40	4 35 14.87	4.5797243
North base	219 48 59.87	39 54 25.84	4.1788524
Willow	239 05 10.47	59 20 44.57	4.5084996
Daly	251 12 18.86	71 23 34.82	4.8291720
South base	253 44 43.50	73 50 35.38	4.0870748

WARD (2), RAVALLI COUNTY.

A second station to be used in the main scheme of triangulation was established on the extreme summit, about 800 feet southwest of Ward (1). A long ridge of easy slope leads to the station from the southeastern side.

Station mark: A copper bolt in the solid rock, above which is a cairn 5 feet in diameter at base and 8 feet in height.

[Latitude $46^{\circ} 10' 14.89''$. Longitude $114^{\circ} 17' 04.18''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
El Capitan	25 37 08.00	205 32 19.60	4.2998100
St. Mary	184 46 01.41	4 47 49.15	4.5820774
Willow	238 55 53.90	59 11 33.24	4.5116335
Daly	250 50 47.11	71 02 12.88	4.8334344

WILLOW, RAVALLI COUNTY.

A station in the base expansion, situated 15 miles northeast of Hamilton, on a bald summit of the range on the eastern side of the Bitterroot Valley and about 4,000 feet above it. It can be reached by following up Willow Creek from Corvallis to a half-finished log cabin; thence up a leading spur to the station, the latter part of the way being through lodge-pole pines and difficult to travel. This station can be used in the extension of triangulation in any direction excepting eastward.

Station mark: A lone tree, trimmed.

[Latitude $46^{\circ} 19' 15.72''$. Longitude $113^{\circ} 55' 28.70''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Daly	37 53 02.00	217 47 48.75	4.0875630
El Capitan	46 38 13.00	226 17 46.10	4.7018600
South base	52 06 38.56	231 56 56.56	4.3401588
Ward (2)	59 11 38.24	238 55 58.90	4.5116330
Ward (1)	59 20 44.57	239 05 10.47	4.5084996
Astronomic pier	65 41 35.41	245 31 37.08	4.2891104
North base	74 49 08.84	254 38 55.30	4.2712508
St. Mary	181 06 18.50	310 52 19.34	4.5129510

ALIAS, TETON COUNTY.

On highest butte, about 10 miles north of Cook's ranch, on Cutbank Creek.

Station mark: An iron bench-mark post set 3 feet in ground.

[Latitude $48^{\circ} 47' 08.07''$. Longitude $112^{\circ} 44' 04.96''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Cutbank	72 16 38.65	252 00 11.85	4.4498243
Lincoln	123 43 09.50	303 29 32.88	4.4239884
Milk River	196 26 39.15	16 30 22.76	4.3289271
Landslide	205 59 54.50	26 04 08.53	4.1951016
Baker	233 01 47.08	53 09 24.16	4.1900240
Connie	350 37 29.81	170 40 27.45	4.4743217

BAKER, TETON COUNTY.

On a low, rounded hill, 5 miles southeast of Landslide butte.

Station mark: An aluminum tablet set in a sandstone rock placed flush with ground.

[Latitude $48^{\circ} 52' 09.18''$. Longitude $112^{\circ} 33' 57.73''$.]

To station—	Azimuth.	Back azimuth.	Log. distarce.
Connie	11 06 56.51	191 02 18.10	4.5960195
Alias	53 09 24.16	233 01 47.08	4.1900240
Lincoln	99 04 05.56	278 42 50.89	4.5425517
Landslide	181 02 08.24	310 58 39.93	8.8624070

BOUNDARY 373, TETON COUNTY.

Situated on the international boundary line between the Dominion of Canada and the United States, about 4 miles east of St. Marys River and on the ridge north of the valley known as Galbreath Basin. The station is 9.7 feet west of the post and stone monument on the international boundary (forty-ninth parallel).

The post is about 5 inches square in a monument of loose rock about 6 feet in diameter and 3 feet high, and is marked "IXXV, IXXIV, Long. 113° 12' 23", 1881." An iron pipe $1\frac{1}{4}$ inches in diameter is set in the ground at north corner of monument. On Cartee's map the post is given as No. 373.

Station mark: An aluminum bolt stamped "U. S. G. S." set in a flat rock sunk in ground.

[Latitude 48° 59' 59.90". Longitude 113° 12' 21.82".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Galbreath.....	26 50 38.70	206 48 11.50	3.9293058
Robertson.....	64 00 07.24	243 44 02.56	4.4623648

CHIEF MOUNTAIN, TETON COUNTY.

A prominent and well-known mountain 4 miles south of the international boundary and on the line between the Blackfeet Indian Reservation and the Flathead Forest Reserve. It can be ascended from camp on Kennedy Creek, 2 miles (air line) southeast of peak, by going around south side and up the ridge near the western end of mountain.

Station mark: An aluminum tablet stamped "9056," cemented in solid rock.

Reference mark: A boundary monument 6 feet high, 3 feet south-east of station mark.

[Latitude 48° 56' 04.16". Longitude 113° 36' 29.86".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Siyeh.....	7 26 28.22	187 24 39.03	4.359613-18
Heavens.....	36 04 59.90	215 53 50.41	4.489229-29
Cleveland.....	87 15 17.32	267 04 30.01	4.242979-29
Galbreath.....	270 32 28.26	90 48 17.87	4.408870-06
Divide.....	332 40 44.32	152 50 08.95	4.524455-56

CLEVELAND, TETON COUNTY.

Highest peak on ridge dividing waters of Little Kootenai Creek (to north) and Belly River (to east). Has cliff about 4,000 feet high on north and east. About the only way to ascend peak is from a point where trail down Little Kootenai Creek crosses a branch from east, about $2\frac{1}{2}$ miles south of Waterton Lake, follow a blazed trail through timber and cross ledges and brush in southeasterly direction, keeping about one-half mile north of creek. Good camp in amphitheater southeast of peak. Ascend wall by spur which reaches top of ridge about one-half mile south of station, about 4,000 or 4,500 feet climb on foot.

Station mark: An aluminum tablet cemented in a flat rock buried in ground under center of a cairn 8 feet high.

[Latitude $48^{\circ} 55' 36.14''$. Longitude $113^{\circ} 50' 47.96''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Heavens	° ' "	° ' "	<i>Meters.</i>
	1 27 45.27	181 27 22.68	4.3820563
Vulture	53 00 36.56	232 52 39.49	4.2086134
Intersection	136 14 22.68	316 10 38.07	3.9422535
Chief Mountain	267 04 30.01	87 15 17.32	4.2429799
Siyeh	326 14 10.44	146 23 07.56	4.4189162

CONNIE, TETON COUNTY.

On a high bluff north of Two Medicine Creek, about $1\frac{1}{2}$ miles east of Shoot's ranch and about 4 miles east of Old Mission.

Station mark: An iron bench-mark post set 3 feet in ground.

[Latitude $48^{\circ} 31' 15.94''$. Longitude $112^{\circ} 40' 08.34''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Cutbank	° ' "	° ' "	<i>Meters.</i>
	123 22 09.97	303 02 47.64	4.5789289
Alias	170 40 27.45	350 37 29.81	4.4743217
Baker	191 02 18.10	11 06 56.51	4.5960195

CUTBANK, TETON COUNTY.

On a salient in the southern escarpment of the high ridge between Cutbank Creek and the South Fork of Milk River, about one-half mile east of the Blackfoot-St. Marys road and about 16 miles from Blackfoot.

Station mark: An aluminum bolt set in a large rock and buried about 3 inches under surface of ground.

Underground mark: A small bottle about 2 feet under surface.

124 PRIMARY TRIANGULATION AND PRIMARY TRAVERSE. [BULL. 201.

[Latitude 48° 42' 28.37". Longitude 113° 05' 57.54".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Divide.....	° ' "	° ' "	<i>Meters.</i>
Divide.....	78 30 23.05	258 16 50.78	4.8537211
Robertson.....			4.5938421
Galbreath.....	154 56 19.85	334 49 09.11	4.4393359
Lincoln.....	191 15 25.89	11 18 17.07	4.3764294
Alias.....	252 00 11.85	72 16 38.65	4.4499243
Connie.....	308 02 47.64	128 22 09.97	4.5789289
Durham.....	349 01 49.31	169 04 21.35	4.3395795

DIVIDE, TETON COUNTY.

On a high, almost isolated peak, about 20 miles northwest from Browning, on western boundary line of the Blackfeet Indian Reservation. It is best reached by going up the South Fork of Milk River to Fox Creek, then up the divide between Fox Creek and the South Fork. This divide is an open prairie; follow up prairie for about 6 miles from mouth of Fox Creek to its end in forest. From this point a blazed trail leads through forest to the foot of the bare peak of the mountain. Go around the north side of the mountain to the west side, then climb slide rock to top.

Station mark: An iron bolt set in solid ledge, above which a rock monument about 5 feet square and 12 feet high was erected. The monument was erected by survey party locating boundary of Blackfeet Reservation, and marks an angle in the boundary line.

Reference mark: A bronze tablet 6 inches below surface and 3 feet 3 inches directly west of center of monument.

[Latitude 48° 40' 01.30". Longitude 113° 23' 58.95".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Stimpson.....	° ' "	° ' "	<i>Meters.</i>
Stimpson.....	42 40 04.16	222 29 55.14	4.3582004
Siyeh.....	111 08 31.11	290 57 18.40	4.2926991
Chief Mountain.....	152 50 08.95	332 40 44.82	4.5244456
Robertson.....	153 58 13.26	333 50 55.74	4.4314489
Galbreath.....	199 23 02.88	19 29 25.94	4.4944507
Cutbank.....	258 16 50.78	78 30 23.05	4.8537211
Durham.....	302 36 06.04	122 52 09.10	4.4952861
Observation.....	346 36 47.00	166 40 04.77	4.369364

DURHAM, TETON COUNTY.

A high point on the ridge three-fourths of a mile south of Durham Station on Great Northern Railway.

Station mark: An aluminum bolt set on a rock 2 feet long buried even with surface of ground.

[Latitude 48° 30' 53.68". Longitude 113° 02' 34.88".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Half Dome	5 36 24.55	185 34 48.53	4.4330247
Elk	36 29 36.39	216 18 14.18	4.5000046
Observation	74 28 54.88	254 16 10.92	4.3875263
Divide	122 52 09.10	302 36 06.04	4.4952861
Cutbank	169 04 21.35	249 01 49.31	4.3395795
Alias	216 55 45.97	37 09 39.24	4.5764569

ELK, TETON COUNTY.

About 6 miles south of Summit Station on Great Northern Railway, on the Continental Divide, between the headwaters of the South Fork of Two Medicine Creek and the south branch of Summit Creek. It is the highest point in the immediate vicinity. It is best reached by going up as far as the prairie extends on the South Fork of Two Medicine and then taking an old trail on the south side of creek, following the creek for about 2 miles, crossing it, and thence on a blazed and cut-out trail for 4 miles to crest of the mountain. It is a difficult trail to travel on account of thick and fallen timber and soft ground.

Station mark: An aluminum bolt set in loose rock under center of cairn 6 feet high.

[Latitude 48° 17' 09.76". Longitude 113° 17' 47.25".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Baptiste	55 15 59.88	235 00 57.26	4.4837563
Stimpson	187 57 42.89	317 43 41.50	4.5376220
Observation	178 32 39.96	353 31 19.30	4.2948174
Durham	216 18 14.18	36 29 36.39	4.5000046
Half Dome	275 17 37.84	95 27 22.93	4.2104101
Pentagon	341 56 23.93	162 04 08.01	4.6206030

FLATTOP, TETON COUNTY.

A secondary station on the southern and highest end of Flattop Mountain, just west of Lower St. Marys Lake.

Station mark: An aluminum bolt set in solid rock, over which is a monument of loose stone 7 feet high and 3 feet in diameter.

[Latitude $48^{\circ} 44' 26.30''$. Longitude $113^{\circ} 31' 09.88''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Galbreath.....	° ' "	° ' "	<i>Meters.</i>
Divide.....	221 55 50.52	42 07 37.80	4.4566111
Divide.....	812 58 08.63	132 58 26.98	4.0798410

GALBREATH, TETON COUNTY.

On eastern end of ridge dividing Galbreath Basin from North Fork of Milk River, about half a mile west of the low divide between Milk River and Galbreath Basin.

Station mark: An aluminum bolt in a stone set 2 feet in ground.

[Latitude $48^{\circ} 55' 54.41''$. Longitude $113^{\circ} 15' 29.84''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Divide.....	° ' "	° ' "	<i>Meters.</i>
Divide.....	19 29 25.94	199 23 02.88	4.4944507
Robertson.....	76 58 00.69	256 44 18.59	4.3581326
Chief Mountain.....	90 48 17.87	270 32 28.26	4.4088709
Boundary post 373.....	206 48 11.50	26 50 33.70	3.9293058
Lincoln.....	275 24 31.66	95 34 35.06	4.2140284
Cutbank.....	334 49 09.11	154 56 19.85	4.4393359

HALF DOME, TETON COUNTY.

On the highest mountain of the "False" Range north of the canyon of Badger Creek. It is a rounded summit with almost vertical face to north, called "Half Dome," from the resemblance to that feature when seen from the northwest, but appearing as a rounded summit from other directions.

Station mark: A copper bolt set in solid rock under a cairn 7 feet high.

[Latitude $48^{\circ} 16' 20.53''$. Longitude $113^{\circ} 04' 43.87''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Pentagon.....	° ' "	° ' "	<i>Meters.</i>
Baptiste.....	4 59 08.68	184 57 09.25	4.5834950
Elk.....	69 06 34.17	248 41 47.27	4.6448796
Observation.....	95 27 22.93	275 17 37.84	4.2104101
Durham.....	139 05 14.01	318 54 07.47	4.4467669
Durham.....	185 34 48.53	5 36 24.55	4.4330247

LANDSLIDE, TETON COUNTY.

On a prominent butte of that name 5 miles south of international boundary.

Station mark: An iron bench-mark post set 3 feet in ground.

[Latitude 48° 54' 43.91". Longitude 112° 38' 27.59".]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Alias.....	26 04 08.53	205 59 54.50	4.1951016
Lincoln.....	91 21 28.54	271 03 36.86	4.4617384
Milk River.....	172 37 36.20	352 37 05.64	3.8077582
Baker.....	310 58 39.93	131 02 03.24	3.8624070

LINCOLN, TETON COUNTY.

On a prominent butte, one-half mile west of "Emigrant Pass" wagon road and 5 miles south of the international boundary.

Station mark: An iron bench-mark post set 3 feet in ground.

[Latitude 48° 55' 03.69". Longitude 113° 02' 09.42".]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Cutbank.....	11 18 17.07	191 15 25.39	4.3764294
Galbreath.....	95 34 35.06	275 24 31.66	4.2140284
Milk River.....	258 16 34.54	78 33 56.13	4.4577635
Landslide.....	271 03 38.86	91 21 28.54	4.4617384
Baker.....	278 42 50.89	99 04 05.56	4.5425517
Alias.....	303 29 32.88	123 43 09.50	4.4239834

MILK RIVER, TETON COUNTY.

On a high butte on east or west bank of Milk River, 1 mile south of the international boundary.

Station mark: An iron bench-mark post sunk 3 feet in ground.

[Latitude 48° 58' 10.12". Longitude 112° 39' 08.12".]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Alias.....	16 30 22.76	196 26 39.15	4.3289271
Lincoln.....	78 33 56.13	258 16 34.54	4.4577635
Landslide.....	352 37 05.64	172 37 36.20	3.8077582

OBSERVATION, TETON COUNTY.

About 6 miles northwest of Midvale station on Great Northern Railway, 4 miles a little south of west of Lower Two Medicine Lake, and 6 miles east of the Continental Divide. It is best reached by taking the trail from the wagon-road bridge over Two Medicine Creek near the upper bull corral of the Indian agency. This trail leads to the station on a shoulder about 1 mile east of highest point, which is an inaccessible crag.

Station mark: Center of drill hole in a rock set in ground under center of cairn 7 feet in height.

[Latitude $48^{\circ} 27' 44.00''$. Longitude $118^{\circ} 19' 35.15''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Baptiste.....	31 40 38.62	211 26 50.30	4.6377352
Stimpson.....	106 03 58.03	285 51 16.29	4.3369737
Divide.....	166 40 04.77	346 36 47.00	4.3693647
Durham.....	254 16 10.92	74 28 54.88	4.3375263
Half Dome.....	318 54 07.47	139 05 14.01	4.4467669
Elk.....	353 31 19.30	173 32 39.96	4.2948174

ROBERTSON, TETON COUNTY.

On the eastern end of Robertson Mountain, being the second peak on the "comb" counting from the east. Only apparent way of reaching it is to climb the rock slide on north side of east end of mountain, passing over the "comb" until station is reached. It is a difficult and somewhat dangerous climb on account of loose rock.

Station mark: An aluminum bolt, stamped "U. S. G. S.", set in solid ledge, over which is a monument of loose rock 9 feet high.

[Latitude $48^{\circ} 53' 06.45''$. Longitude $118^{\circ} 38' 40.65''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Galbreath.....	256 44 18.59	76 58 00.69	4.3581326
Divide.....	333 50 55.74	153 58 13.26	4.4314486

ROCKY, TETON COUNTY.

Highest peak of range to east of the North Fork of Sun River, about 6 miles west of "Ear" (or "Elephant's Ear") Butte, and 4 miles south west of Friar's sawmill, on South Fork of Teton River, about 6 miles east of North Fork of Sun River. It is on divide between waters of

the South Fork of Teton River and waters of the North Fork of Sun River. Best route of ascent is from the south.

Station mark: A copper bolt marked "U. S. G. S. Δ " set in a stone buried flush with surface.

Reference mark: A cairn 8 feet high, 11.5 feet east of station mark.

[Latitude $47^{\circ} 48' 50.38''$. Longitude $112^{\circ} 47' 56.36''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
S capegoat	2 13 21.57	182 12 05.39	4.7474380
W hiteridge	44 49 20.21	224 40 21.14	4.3334810
C liff	55 04 43.69	234 50 07.95	4.4787721
S ilvertip	84 55 43.91	264 35 41.52	4.5304282
P entagon	117 54 29.90	297 40 04.06	4.4381328
C arey	322 40 29.10	142 55 47.19	4.6321238
F airview	354 09 32.49	174 11 44.97	4.5665988

SIYEH, TETON COUNTY.

About 5 miles south of Altyn post-office and just south of the Crack-
e ~~er~~—jack copper mine. Go up creek from Altyn 2 miles south, thence
over a winding trail up east side of mountain to the canyon from east,
which ascend south then east up the creek entering at head of amphitheater. At top of ridge go on foot over the crest of peaks for about
3 miles; this is a long and difficult climb. Peak slopes 45° south and
falls off nearly perpendicular 4,500 feet on the north.

Station mark: A bronze tablet wedged into a drill hole in a large
rock 2 feet lower than base of reference mark.

Reference mark: A stone monument 4 feet high, erected 5 feet
northwest of station mark, on the highest part and close to the
precipice.

[Latitude $48^{\circ} 43' 49.43''$. Longitude $113^{\circ} 38' 54.41''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
H eavens	81 36 27.41	261 27 08.56	4.1866002
V ulture	113 52 35.32	293 35 42.22	4.4776027
C leveland	146 23 07.56	326 14 10.44	4.4189162
C hief Mountain	187 24 39.03	7 26 28.22	4.3596134
D ivide	290 57 18.40	111 08 31.11	4.2926991
S timpson	353 01 46.16	173 02 48.84	4.3805672

ARIZONA-NEW MEXICO.

TRIANGULATION STATIONS.

Arizona.

Triangulation in south-central Arizona was extended eastward from stations Black Hawk, Blair, and Coal by Thomas Winsor and Jeremiah Ahern during the season of 1900, and extended still farther eastward into New Mexico by R. H. Chapman, topographer, during November and December, 1901. Three 30-minute quadrangles in Arizona and two in New Mexico were controlled by fifteen stations. A check azimuth was observed near Morenci.

Geographic location of points in vicinity of Globe, Ariz.

Name of mine.	Point located.	Latitude.	Longitude.
MINE LOCATIONS.			
Hoosier	Hoisting rope	33° 24' 54.22"	110° 46' 53.59"
Old Dominion shaft	Hoisting rope	33° 24' 87.54"	110° 47' 23.44"
Gray Hoist	Hoisting rope	33° 25' 04.62"	110° 46' 41.92"
Gray Incline	Hoisting rope	33° 25' 07.86"	110° 46' 38.88"
Copper Hill	Hoisting rope	33° 25' 21.81"	110° 46' 29.61"
Cuprite mine	Hoisting rope	33° 25' 11.86"	110° 46' 34.99"
Globe Public School	Flag pole in yard of public school.	33° 23' 47.30"	110° 47' 27.92"

CENTER STATION, GILA COUNTY.

About 200 feet southwest of summit of ridge extending in a north-east direction from the Buffalo mine, about 1,800 feet from Buffalo mine and about 1,900 feet from the Gray mine.

Station mark: A bronze tablet cemented in rock in place.

Latitude 33° 25' 14.60". Longitude 110° 47' 00.94".

NORTH EAST STATION, GILA COUNTY.

Summit of highest hill, about nine-tenths mile southeast of Black Hawk triangulation station.

Station mark: A bronze tablet cemented in rock in place.

Latitude 33° 25' 30.09". Longitude 110° 45' 29.39".

NATANES, GILA COUNTY.

Situated on summit of cone-shaped butte of same name about 40 miles northeast of San Carlos, one-third mile west of trail to Fort Apache, 4 miles south of Black River, and 4 miles northeast of horse camp and corral of Chiricahua Cattle Company.

Station mark: A bronze triangulation tablet cemented in point of

solid rock in about center of top of butte, over which is built a monument of rocks and brush.

[Latitude $33^{\circ} 38' 36.00''$. Longitude $110^{\circ} 07' 46.67''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Turnbull.....	◦ ' "	◦ ' "	<i>Meters.</i>
Triplets.....	12 50 31.76	192 46 10.88	4.7437771
Gila.....	40 26 35.12	220 19 17.19	4.5006441
	337 57 16.68	158 03 07.34	4.6433701

ASH PEAK, GRAHAM COUNTY.

0

(Not occupied.)

A sharp conical peak on range east of Gila River, about 12 miles northwest of Duncan and 7 miles west of river. Is close to public road from Duncan to Solomonsville.

[Latitude $32^{\circ} 45' 00.7''$. Longitude $109^{\circ} 15' 45.4''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Guthrie.....	◦ ' "	◦ ' "	<i>Meters.</i>
Line.....	161 57 34	341 55 52	4.19903
	245 50 31	65 50 08	4.43456

AZIMUTH (2), GRAHAM COUNTY.

Situated on summit of small knoll on divide, three-tenths mile south of Morenci, 260 yards southeast of two water tanks.

Station mark: A large stone post, in center of top of which is cemented a bronze tablet.

[Latitude $33^{\circ} 04' 17.00''$. Longitude $109^{\circ} 22' 00.69''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Sunset.....	◦ ' "	◦ ' "	<i>Meters.</i>
Guthrie.....	246 57 47	67 02 20	4.149184
	346 43 02	166 44 44	4.325316

BRYCE, GRAHAM COUNTY.

Situated on summit of highest peak in Gila Range, about 15 miles northeast of town of Pima and about 3 miles east of wagon road from Bryce to Ash Flat.

Station mark: A bronze triangulation tablet cemented in solid rock.

Reference mark: A large cairn, 14 feet distant from station mark; azimuth of mark from station, $148^{\circ} 37'$.

[Latitude 33° 01' 06.62". Longitude 109° 40' 22.94".]

To station—	Azimuth.	Back azimuth.	Log. distance.
• / " 27 52 18.37	• / " 207 45 49.73		<i>Meters.</i>
Graham.....			4.6010908
Turnbull.....	96 23 20.23	276 04 04.88	4.7427259
Gila.....	126 31 02.72	306 21 53.10	4.5110005
Sunset.....	254 34 42.17	74 49 16.71	4.6344900
Guthrie.....	293 38 02.07	113 49 43.31	4.5632224

GILA, GRAHAM COUNTY.

Situated on summit of Gila Peak, about 12 miles northeast of Geronimo and one-half mile west of the Hooker trail from Geronimo to Ash Flat.

Station mark: A bronze triangulation tablet cemented in solid rock, over which is built a cairn.

[Latitude 33° 11' 32.00". Longitude 109° 57' 09.23".]

To station—	Azimuth.	Back azimuth.	Log. distance.
• / " 65 22 46.27	• / " 245 12 38.24		<i>Meters.</i>
Turnbull.....			4.5016173
Triplets.....	114 19 19.78	294 06 14.30	4.6088877
Natahes.....	158 03 07.34	337 57 16.68	4.6433704
Bryce.....	306 21 53.10	126 31 02.72	4.5110005
Graham.....	352 07 05.84	172 09 43.55	4.7410079

GRAHAM, GRAHAM COUNTY.

On easternmost peak of a high, timbered mountain, about 20 miles south of the town of Pima. Wagon road via Cluff's ranch from Pima to summit of main ridge near Cluff's sawmill, which is about 4 miles west of station. Good trail along ridge to station. Theodolite elevated 35 feet.

Station mark: A bronze triangulation tablet cemented in solid rock.

[Latitude 32° 42' 00.75". Longitude 109° 52' 19.25".]

To station—	Azimuth.	Back azimuth.	Log. distance.
• / " 138 40 17.18	• / " 318 27 35.69		<i>Meters.</i>
Turnbull.....			4.7410352
Gila.....	172 09 43.55	352 07 05.84	4.7410079
Bryce.....	207 45 49.73	27 52 18.37	4.6010908
Guthrie.....	248 19 42.27	68 37 48.46	4.7489196
Secho.....	284 14 41.16	104 43 43.49	4.9399787

GUTHRIE, GRAHAM COUNTY.

Situated on the highest point between Green & Sons' toll road from Solomonsville to Coronado and the Gila River. Station is 2 miles northwest of summit of above road.

Station mark: A $\frac{1}{2}$ -inch iron bolt wedged with nails in a hole drilled in solid rock, over which is built a cairn 8 feet in diameter and 8 feet high.

[Latitude $32^{\circ} 58' 08.75''$. Longitude $109^{\circ} 18' 58.75''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	Meters.
Graham.....	68 37 48.46	248 19 42.27	4.7489196
Bryce.....	113 49 43.31	293 38 02.07	4.5632224
Morenci.....	164 00 19.10	343 58 00.50	4.3795070
Sunset.....	197 17 57.00	17 20 47.78	4.4867053
Line.....	277 27 30.68	97 37 50.86	4.4766777
Secho.....	322 50 47.82	143 01 51.29	4.7250061

MORENCI, GRAHAM COUNTY.

A three-point station, situated on a peak about 2 miles northwest of town of Morenci. A good trail from Morenci on south slope of peak reaches top of ridge about one-half mile west of station, at which point leave trail and travel along ridge to station.

Station mark: A bronze triangulation tablet cemented in solid rock.

Reference mark: A cairn 4 feet in diameter and 5 feet high, 4 feet north of station mark.

[Latitude $33^{\circ} 05' 36.40''$. Longitude $109^{\circ} 23' 08.35''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	Meters.
Sunset.....	258 12 38	78 17 48	4.177416
Line.....	306 30 43	126 43 23	4.655230
Guthrie.....	343 58 00	164 00 19	4.379507

PIMA CHURCH, GRAHAM COUNTY.

(Not occupied.)

Station mark: Spire on Mormon church at Pima.

[Latitude $32^{\circ} 53' 26.97''$. Longitude $109^{\circ} 49' 34.35''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	Meters.
Graham.....	11 29 09	191 27 40	4.333842
Bryce.....	225 17 05	45 22 05	4.304064

SHANNON, GRAHAM COUNTY.

Summit of Shannon Mountain, one-half mile northeast of town of Metealf, 150 yards east of the office of the Shannon Mining Company.

Station mark: A bronze bench-mark tablet set in rock, over which a small cairn was built.

[Latitude 33° 07' 02.50". Longitude 109° 21' 35.89".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Guthrie	350 40 48	170 42 16	4.41543
Azimuth (2)	367 11 27	187 11 14	3.71082

SUNSET, GRAHAM COUNTY.

Situated 6 miles northeast of town of Clifton, on mountain locally known as Sunset Mountain. Wagon road from Clifton to old slaughter corral on Limestone wash about 2 miles above its mouth, thence by good trail taking left hand (to N.) to gap east of station, thence dim trail to station.

Station mark: A bronze triangulation tablet cemented in solid rock, over which is built a cairn 6 feet in diameter and 7 feet high.

[Latitude 33° 07' 15.81". Longitude 109° 13' 40.22".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Guthrie	17 20 47.78	197 17 57.00	4.4967053
Bryce	74 49 16.71	254 34 42.17	4.6344900
Morenci	78 17 48.4	258 12 38.10	4.1774160
Pleasant	233 35 23.45	53 44 52.90	4.5235914
Mogollon	254 12 01.18	74 32 48.81	4.7873988
Canyon	276 51 41.38	97 16 44.58	4.8571778
Line	324 17 52.14	144 25 28.59	4.5676142
Secho	340 45 48.18	160 54 03.87	4.8602010

TRIPLETS, GRAHAM COUNTY.

Situated on summit of highest of three peaks known as The Triplets, about 12 miles northeast of San Carlos and 2 miles northwest of Hackberry Springs on old San Carlos and Fort Apache road.

Station mark: A bronze triangulation tablet cemented in solid rock, over which is built a cairn.

[Latitude $33^{\circ} 20' 32.95''$. Longitude $110^{\circ} 21' 01.12''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Coal	87 18 55.33	217 11 30.46	4.5408219
Black Hawk	105 03 56.49	284 50 10.38	4.6037580
Natahes	220 19 17.19	40 26 35.12	4.5006441
Gila	294 06 14.30	114 19 19.76	4.6088877
Turnbull	344 31 27.14	164 34 22.10	4.4921118

TURNBULL, GRAHAM COUNTY.

Situated on summit of sharp, rocky, isolated peak known as Mount Turnbull, about 15 miles southeast of San Carlos and 15 miles west of Geronimo.

Station mark: A bronze triangulation tablet cemented in solid rock, over which is built a cairn.

[Latitude $33^{\circ} 04' 21.87''$. Longitude $110^{\circ} 15' 41.67''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Coal	94 31 40.94	274 21 28.30	4.4688635
Black Hawk	130 40 04.24	310 23 25.91	4.7924053
Triplets	164 34 22.10	344 31 27.14	4.4921118
Natahes	192 46 10.88	12 50 31.76	4.7487771
Gila	245 12 38.24	65 22 46.27	4.5016173
Bryce	276 04 04.88	96 23 20.23	4.7427259
Graham	318 27 35.69	198 40 17.18	4.7410352

New Mexico.

BULLARD, GRANT COUNTY.

Situated on a rocky cone (200 by 50 feet on top) about 20 miles southeast of Cliff post-office. A good wagon road from Cliff via Mango Springs, "H W" ranch, and Saddle Rock Canyon to foot of peak, 1 mile from station.

Station mark: A bronze triangulation tablet cemented in solid rock, over which is built a cairn 9 feet high and 4 feet in diameter.

[Latitude 32° 42' 26.95". Longitude 108° 32' 18.36".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Secho	61 10 38.66	240 56 34.21	4.6692474
Line	110 20 16.09	290 05 21.36	4.6611612
Pleasant	150 23 41.25	330 10 35.08	4.8784318
Canyon	190 48 06.90	10 50 34.58	4.5760629

CANYON, GRANT COUNTY.

Situated about 6 miles northeast of Cliff post-office, on a sharp, brushy hill, on rocky ridge south and east of Gila River. Easily ascended from Gila River west of station up level grassy ridge, thence to first gap south of hill, thence north on ridge to station.

Station mark: A bronze triangulation tablet cemented in solid rock.

[Latitude 33° 02' 28.22". Longitude 108° 27' 46.24".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Bullard	10 50 34.58	190 48 06.90	4.5760629
Line	67 11 46.73	246 54 19.96	4.7347506
Sunset	97 16 44.58	276 51 41.38	4.8571778
Pleasant	122 55 39.16	302 40 00.62	4.7232391
Mogollon	154 08 38.08	334 04 18.19	4.4502461

CLIFF, GRANT COUNTY.

A secondary station situated 100 yards north of Heather's store (Cliff post-office), 25 yards east of stage road to Mogollon, and about 20 feet southwest of northeast corner of northeast quarter of northeast quarter of sec. 32, T. 15 S., R. 17 W.

Station mark: Center of windmill.

[Latitude 32° 57' 39.35". Longitude 108° 36' 44.80".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Mogollon	182 44 23	2 44 58	4.58539
Canyon	237 28 54	57 33 48	4.21999

LINE, GRANT COUNTY.

Situated about 15 miles in a northerly direction from Duncan, Ariz., being on the highest point visible from that place. A road from Dun-

can to a cow camp about 2 miles south of station. Water at cow camp, also on road about 3 miles from same. Station is best reached from Steeplerock, a mining camp about $1\frac{1}{2}$ miles northeast of station.

Station mark: A bronze triangulation tablet cemented in solid rock, above which a cairn 6 feet high was erected.

[Latitude $32^{\circ} 51' 01.02''$. Longitude $108^{\circ} 59' 50.99''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Guthrie	97 37 50.86	277 27 30.68	4.4766777
Sunset	144 25 23.59	324 17 52.14	4.5676142
Mogollon	218 49 45.46	39 02 56.22	4.7769400
Canyon	246 54 19.96	67 11 46.73	4.7347506
Bullard	290 05 21.36	110 20 16.09	4.6611612
Secho	356 40 32.01	176 41 18.18	4.5853982

SECHO, GRANT COUNTY.

Situated on highest of low isolated hills about 3 miles east of Arizona and New Mexico Railway and about 4 miles northeast of section house at Summit station, about halfway between Lordsburg, N. Mex., and Duncan, Ariz.

Station mark: A hole drilled in solid rock, over which a cairn 7 feet in diameter and $7\frac{1}{2}$ feet high was erected.

[Latitude $32^{\circ} 30' 13.46''$. Longitude $108^{\circ} 58' 25.47''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Graham	104 43 48.49	284 14 41.16	4.9399787
Guthrie	143 01 51.29	322 50 47.82	4.7250061
Sunset	160 54 03.87	340 45 48.18	4.8602010
Line	176 41 18.18	356 40 32.01	4.5853982
Bullard	240 56 34.21	61 10 38.66	4.6692474

MOGOLLON, SOCORRO COUNTY.

Situated on the highest peak of the Mogollon range, locally known as "Baldy," about 10 miles north of Farquar's ranch on Mogollon Creek. Bare on south and southwest slopes; east and north slopes timbered.

Station mark: A bronze triangulation tablet cemented in triangular stone about 18 by 14 by 14 inches, set 10 inches in the ground. Underneath stone on center a ".30-caliber Government" cartridge shell is driven in ground. A cairn 4 feet high was built over mark.

138 PRIMARY TRIANGULATION AND PRIMARY TRAVERSE. [BULL. 201.

[Latitude $33^{\circ} 16' 11.73''$. Longitude $108^{\circ} 35' 41.44''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Line	39 02 56.22	218 49 45.46	4.7769400
Sunset	74 32 48.81	254 12 01.18	4.7873988
Canyon	334 04 18.19	154 08 38.08	4.4502461

PLEASANT, SOCORRO COUNTY.

Situated on highest point of brushy mountain about 3 miles due west from Pleasanton. Brush and timber cleared from summit in 1901. Easily ascended from "Frisco" River at Pleasanton via lane to west side of river and then by cattle trail to top of ridge, thence northward to station.

Station mark: A bronze triangulation tablet cemented in boulder in place.

[Latitude $33^{\circ} 17' 57.90''$. Longitude $108^{\circ} 56' 21.62''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Sunset	53 44 52.30	238 35 23.45	4.5235914
Canyon	302 40 00.62	122 55 39.16	4.7232391
Bullard	330 10 35.08	150 28 41.25	4.8784318

PACIFIC SECTION OF TOPOGRAPHY.

CALIFORNIA.

TRIANGULATION STATIONS.

Central California.

Control for the three fifteen-minute quadrangles south and east of Mount Diablo is based upon Mocho and Diablo stations of the Coast and Geodetic Survey. In addition to these, seven other stations were occupied, and three secondary points were located by Mr. C. F. Urquhart, topographer, in November and December, 1901. Positions are given on the "United States standard datum."

BROWN, ALAMEDA COUNTY.

Situated on a high prairie point in pasture land owned by Mr. Brown. It is best reached from Livermore via road up Mocho Creek to summit of ridge, thence a road turns northwest and passes very near station.

Station mark: A small pile of rock around signal tree.

[Latitude $37^{\circ} 36' 22.98''$. Longitude $121^{\circ} 37' 10.84''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Trenouth	61 53 05.56	241 43 55.02	4.4006441
Sunol	98 25 59.84	278 14 56.27	4.4266916
Wiedeman	114 04 36.83	298 50 52.92	4.5581580
Brushy	157 51 19.54	337 48 17.29	4.2868343
Byron	172 32 14.88	352 30 27.36	4.5189234
Bridge	195 00 51.94	15 08 31.56	4.3915751

BRUSHY, ALAMEDA COUNTY.

Situated about 8 miles by road from Livermore on a mountain locally known as "Brushy Peak." It is best reached from Livermore by road to Joseph Laughlin's residence, $6\frac{1}{2}$ miles, thence up mountain. Mountain is covered with live-oak trees, all of which were cut from summit. No other timbered mountain near.

Station mark: A hole drilled in rock and filled with lead, above which is erected a rock monument with small tree in center.

[Latitude $37^{\circ} 46' 04.42''$. Longitude $121^{\circ} 42' 08.96''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Trenouth	26 30 49.72	206 24 40.21	4.5224301
Sunol	49 48 47.05	229 40 44.55	4.4036711
Wiedeman	82 54 01.66	262 43 18.78	4.4134343
Diablo	124 22 25.82	304 14 40.12	4.3518752
Byron	191 24 54.45	11 26 09.60	4.1796710
Bridge	246 44 12.87	66 49 55.48	4.1727068
Brown	337 48 17.29	157 51 19.54	4.2868343
Mocho	337 58 21.85	158 03 45.51	4.5407469

LEAL, ALAMEDA COUNTY.

(Not occupied.)

Situated on a high knoll, cleared of timber, about 1 mile east from Mr. Leal's cabin. To reach station take road east from Sunol to within three-fourths mile of Appleton's ranch, thence take left-hand road up creek and ridge to Leal's ranch. Signal can be seen from several points on a road along ridge.

Station mark: A rock monument 6 feet high with tree in center.

[Latitude $37^{\circ} 40' 41.48''$, Longitude $121^{\circ} 43' 26.39''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Trenouth	° ' "	° ' "	<i>Meters.</i>
Sunol	124 44 25	304 37 11	4.11502
Wiedeman			4.32713
Brushy	183 48 38	3 49 25	4.54040
Mocho			4.45511
			4.18723

LIVERMORE, ALAMEDA COUNTY.

(Not occupied.)

Station is the Catholic Church in the town of Livermore.

Station mark: Center of church spire.

[Latitude $37^{\circ} 41' 05.23''$. Longitude $121^{\circ} 45' 55.37''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Trenouth	° ' "	° ' "	<i>Meters.</i>
Sunol	62 39 54	242 34 10	4.35381
Wiedeman	106 35 12	286 26 48	4.19126
Brushy			4.32308
Brown			4.03192
			4.19110

LONE PINE, ALAMEDA COUNTY.

(Not occupied.)

Situated about 2 miles northeast of Leal station, on line between Leal and Brown, on summit of knoll covered with scattering oak trees.

Station mark: A lone pine tree near summit, standing much higher than other trees.

[Latitude $37^{\circ} 31' 40.94''$. Longitude $121^{\circ} 42' 20.26''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Trenouth	° ' "	° ' "	<i>Meters.</i>
Sunol	118 18 23	298 10 29	4.17398
Brown	221 06 17	41 09 26	4.33576
Mocho			4.06236
			4.15909

SUNOL, ALAMEDA COUNTY.

Situated on the highest point of a prairie ridge running about northwest from Sunol. Take road up Sinbar Creek for about 3 miles, or until the second bridge is passed, thence up ridge on west side of creek about 1 mile to signal.

Station mark: A rock with hole drilled in it and filled with lead, above which was built a rock monument with tree in center about 9 feet high.

[Latitude $37^{\circ} 37' 13.48''$. Longitude $121^{\circ} 55' 18.08''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Wiedeman	154 03 20.18	334 00 40.71	4.1643781
Diablo	181 25 58.89	1 26 17.08	4.4631686
Brushy	229 40 44.55	49 48 47.05	4.4036711
Livermore	242 34 10	62 39 54	4.19126
Brown	273 14 56.27	93 25 59.84	4.4266916
Lone Pine	298 10 29	118 18 23	4.33576
Leal	304 37 11	124 44 25	4.32713
Trenouth	341 25 00.88	161 26 53.02	4.1516486

TRENOUTH, ALAMEDA COUNTY.

Situated on mountain locally known as Trenouth Mountain, being the highest point of ridge between Alameda Creek and the Santa Clara Valley, and about $1\frac{1}{2}$ miles southeast from Mission Mountain. A road from Mission San Jose (a small town) goes up mountain to Mr. Trenouth's residence, which is about one-half mile northeast of station.

Station mark: A rock 18 by 6 by 6 inches set 18 inches in the ground, in top of which a hole was drilled and filled with lead, above which was erected a rock monument with small tree in center.

[Latitude $37^{\circ} 29' 57.49''$. Longitude $121^{\circ} 52' 14.13''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Wiedeman	157 42 48.20	337 38 16.65	4.4581934
Sunol	161 26 53.02	341 25 00.88	4.1516486
Livermore			4.35381
Brushy	206 24 40.21	26 30 49.72	4.5224301
Brown	241 43 55.02	61 53 05.56	4.4006441
Lone Pine			4.17398
Leal			4.11502

BRIDGE, CONTRA COSTA COUNTY.

Situated about 4 miles southeast of Byron and 2 miles northeast of the Southern Pacific Railroad. The station is the most northeastern of four high towers built to carry electric-power wires from Stockton to San Jose over the San Joaquin River.

Station mark: Center of tower.

[Latitude $37^{\circ} 49' 14.72''$. Longitude $121^{\circ} 32' 49.89''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Brown	15 03 31.56	195 00 51.94	4.3915751
Brushy	66 49 55.48	246 44 12.87	4.1727068
Byron	130 02 51.46	309 58 23.53	4.1440237

BYRON, CONTRA COSTA COUNTY.

Situated on railroad right of way, about one-fourth mile northwest from Byron and Brentwood county road. It is on south side of railroad about 40 feet from track, on a hill through which the railroad passes in an open cut. Mr. Henry McCabe's residence is about one-fourth mile southeast of station.

Station mark: A telegraph pole.

Reference mark: A rock with small hole drilled in it and "U. S." cut on it, 3.6 feet northwest of telegraph pole.

[Latitude $37^{\circ} 54' 05.25''$. Longitude $121^{\circ} 40' 06.44''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Brushy	11 26 09.60	191 24 54.45	4.1796710
Diablo	84 22 28.90	264 13 27.25	4.3355799
Bridge	309 58 23.53	130 02 51.46	4.1440237
Brown	352 30 27.36	172 32 14.88	4.5189234

DIABLO, CONTRA COSTA COUNTY.

A station of the Coast and Geodetic Survey on summit of well-known mountain of that name.

Station mark: A copper bolt cemented in solid rock, above which was erected a brick pier.

[Latitude $37^{\circ} 52' 55.48''$. Longitude $121^{\circ} 54' 48.36''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Sunol	1 26 17.08	181 25 58.89	4.4631686
Wiedeman	24 05 36.49	204 02 38.33	4.2413220
Byron	264 13 27.25	84 22 28.90	4.3355799
Brushy	304 14 40.12	124 22 25.82	4.3518752
Brown	319 40 30	139 51 16	4.60295
Mocho	324 44 31.77	144 57 40.03	4.7394918
Trenouth	354 54 16	174 55 52	4.62994

WIEDEMAN, CONTRA COSTA COUNTY.

Situated on highest point of a prairie ridge about 3 miles southwest of San Ramon. It can be reached by road from San Ramon to Mr. Christopher Wiedeman's house, thence by trail three-fourths mile up hill.

Station mark: A hole drilled in rock and filled with lead, above which was erected a rock monument with tree in center.

[Latitude $37^{\circ} 44' 19.26''$. Longitude $121^{\circ} 59' 38.97''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Diablo	204 02 38.33	24 05 36.49	4.2413220
Brushy	262 43 18.78	82 54 01.66	4.4134343
Livermore	286 26 48	106 35 12	4.32308
Brown	293 50 52.92	114 04 36.83	4.5581580
Mocho	306 38 18.69	126 54 23.02	4.6847231
Leal	316 30 21	136 40 13	4.54040
Sunol	334 00 40.71	154 03 20.18	4.1643781
Trenouth	337 38 16.65	157 42 48.20	4.4581934

MOCHO, SANTA CLARA COUNTY.

A Coast and Geodetic Survey station, situated on highest point of mountain locally known as Eylar Mountain. It can be reached by a good mountain road from Livermore up Mocho Creek to cabin at foot of Eylar Mountain, 18 miles from Livermore, thence a good trail to station, which is about $1\frac{1}{2}$ miles up the ridge from old cabin at Banta Springs.

Station mark: A stone pier 4 feet high.

Reference mark: A rock monument with tree 14 feet high in center used as signal, 3.5 feet east of station mark.

144 PRIMARY TRIANGULATION AND PRIMARY TRAVERSE. [BULL. 201.

[Latitude, $37^{\circ} 28' 39.696''$. Longitude, $121^{\circ} 33' 18.781''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Leal	° ' "	° ' "	Meters.
Lone Pine			4.18725
Wiedeman	126 54 23.02	306 38 18.69	4.6847231
Diablo	144 57 40.03	324 44 31.77	4.7394918
Brushy	158 08 45.51	387 58 21.85	4.5407463
Brown			4.18684

Randsburg Mining District.

Four 3-point stations for the control of the Randsburg mining district were occupied by Mr. R. U. Goode, geographer, during the latter part of September, 1900, with an 8-inch theodolite reading by verniers to 10 seconds. Positions were computed from the following stations of the Wheeler survey, which were connected with the transcontinental triangulation of the United States Coast and Geodetic Survey in 1901, and recomputed on United States standard datum.

	Latitude.	Longitude.
	° ' "	° ' "
Telescope	36 10 12.8	117 05 20.0
Olancha	36 15 55.5	118 07 03.0
Maturango	36 07 13.3	117 29 41.7
Owens	35 44 18.6	117 59 47.0

GOVERNMENT, KERN COUNTY.

On the point locally known as Government Peak, $1\frac{1}{2}$ miles southwest from Randsburg and above the Yellow Aster mine.

Station mark: A cairn 5 feet in height.

[Latitude $35^{\circ} 21' 08.29''$. Longitude $117^{\circ} 40' 24.35''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	Meters.
El Paso	181 45 30.87	311 39 38.03	4.3134470
Olancha	158 30 59.96	338 15 24.58	5.0373238
Laurel	176 04 47.05	356 04 24.63	4.1543844
Telescope	210 03 09.50	30 23 39.29	5.0212863
Johannesburg	237 11 29.13	57 12 47.25	3.6079340
Red	272 23 39.14	92 26 44.85	3.9091392

LAUREL, KERN COUNTY.

On a peak locally known as Laurel Mountain, about 4 miles a little south of west from Gorden station (Searles post-office), being the first high point in that direction.

Station mark: A cairn 6 feet in height.

[Latitude 35° 28' 50.20". Longitude 117° 41' 08.05".]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	Meters.
El Paso	87 53 09.80	267 47 38.86	4.1579419
Dome	290 27 11.38	110 33 03.17	4.2129570
Red	328 04 05.53	148 07 38.95	4.2348120
Government	356 04 24.63	176 04 47.05	4.1548844

DOME, SAN BERNARDINO COUNTY.

On a high rocky point about 8 miles northeast from Johannesburg, in sec. 7, T. 29 S., R. 42 E.

Station mark: A cairn 6 feet high.

[Latitude 35° 25' 44.63". Longitude 117° 30' 56.55".]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	Meters.
Red	35 08 02.03	215 05 39.10	4.0346145
Laurel	110 33 03.17	290 27 11.38	4.2129570

EL PASO, SAN BERNARDINO COUNTY.

A station of the Wheeler survey.

[Latitude 35° 28' 32.61". Longitude 117° 50' 33.38".]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	Meters.
Laurel	267 47 38.86	87 53 09.80	4.1579419
Government	311 39 38.03	131 45 30.87	4.3134470

JOHANNESBURG, SAN BERNARDINO COUNTY.

South end of the station gable.

[Latitude 35° 22' 19.55". Longitude 117° 38' 09.36".]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	Meters.
Red	298 22 57.23	118 24 44.86	3.7273887
Government	57 12 47.25	237 11 29.13	3.6079340

RED, SAN BERNARDINO.

About 3 miles southeast of Johannesburg, on the highest point of Red Mountain.

Station mark: A cairn 5 feet high.

[Latitude $35^{\circ} 20' 57.17''$. Longitude $117^{\circ} 35' 08.87''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Government	92 26 44.85	272 23 39.14	3.9091392
Johannesburg	118 24 44.86	298 22 57.28	3.7273887
Laurel	148 07 33.95	328 04 05.53	4.2348120
Telescope	206 02 44.48	26 20 06.65	5.0065190
Dome	215 05 39.10	35 08 02.03	4.0346145

Sierra Forest Reserve.

Mr. E. T. Perkins, jr., topographer, continued the belt of triangulation of the previous year southward along the high Sierras to Tehachapi Pass. Besides reoccupying 2 stations, he built and occupied 11 new stations, some of which were formerly located by the Wheeler survey.

This work was further extended and connected with that in southern California by Mr. Urquhart in December, 1901.

The work furnishes control for six 30-minute quadrangles in Tulare and Kern counties.

Positions were computed from the south from the line Frazier-Libre on Yolo standard datum, but a correction of $+6.53''$ in latitude and $-3.60''$ in longitude was applied to reduce the positions published herewith to the "U. S. Standard" of the Coast and Geodetic Survey.

BRECKINRIDGE, KERN COUNTY.

The station is at the eastern end of Breckinridge Mountain, a heavily timbered plateau south of the Kern River, 6 miles west of Havilah. It can be ascended from Rankins Ranch in Walker Basin by following the main ridge.

Station mark: A bronze triangulation tablet cemented in the top of a ledge which projects 10 or 12 feet above surface of ground, surmounted by a cairn 5 feet high.

[Latitude $35^{\circ} 27' 03.86''$. Longitude $118^{\circ} 34' 58.89''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Sunday	179 49 37.92	359 49 35.35	4.5655670
Big Meadows	203 16 37.60	23 25 23.77	4.7575669
Pah Ute	269 52 04.54	89 58 45.66	4.2415837
Cache	309 51 59.73	130 03 33.88	4.5971175
Old Town	351 04 52.21	171 06 46.54	4.5091169

CACHE, KERN COUNTY.

A peak at the head of Cache Creek, about 10 miles northeast of Cameron station on Southern Pacific Railroad. The name of creek and peak was taken from Wheeler map. Water was found at an old Indian camp at west foot of peak.

Station mark: A bronze triangulation tablet cemented in solid rock, above which a cairn 9 feet high was erected.

[Latitude 35° 13' 19.63". Longitude 118° 14' 58.66".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Pajuela	19 49 57.53	199 48 25.51	4.0763916
Double	45 34 00.61	225 25 53.94	4.4775061
Old Town	75 41 49.28	255 32 11.59	4.4179828
Breckinridge	180 03 33.88	309 51 59.73	4.5971175
Pah Ute	153 14 10.77	333 09 16.60	4.4546164
Soledad	348 04 51.10	168 06 58.16	4.4335946

DOUBLE, KERN COUNTY.

A partly timbered double peak about 6 miles southwest of Tehachapi, at the head of Oak Creek. It can be ascended from camp at old sawmill 3 miles up the creek from Piffords.

Station mark: A bronze triangulation tablet cemented in solid rock, above which a cairn 9 feet high was erected.

[Latitude 35° 01' 56.68". Longitude 118° 29' 04.49".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Liebre	12 15 32.28	192 12 23.37	4.5980058
Frazier	57 21 04.14	237 04 26.93	4.7212601
Old Town	164 45 32.38	344 44 02.36	4.1789222
Pah Ute	190 22 09.83	10 25 24.40	4.6743668
Cache	225 25 53.94	45 34 00.61	4.4775061
Pajuela	240 27 27.11	60 34 01.36	4.3003508
Soledad	281 25 36.86	101 35 48.84	4.4410062

OLD TOWN, KERN COUNTY.

A low peak at the northern edge of Tehachapi Pass, about 2 miles north of the old settlement of Tehachapi.

Station mark: A bronze triangulation tablet cemented in solid rock, surmounted by a cairn 6 feet high.

[Latitude 35° 09' 48.59". Longitude 118° 31' 41.06".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Breckinridge	171 06 46.54	351 04 52.21	4.5091169
Pah Ute	201 18 06.13	21 22 51.50	4.5350191
Cache	255 32 11.59	75 41 49.28	4.4179828
Pajuela	282 23 32.81	102 31 37.32	4.3398768
Double	344 44 02.36	164 45 32.38	4.1782222

OWENS, KERN COUNTY.

(Not occupied.)

A high peak 20 miles east of Kernville, on the waters of the South Fork of Kern River.

Station mark: A cairn probably erected by the Wheeler Survey.

[Latitude 35° 44' 18.60". Longitude 117° 59' 46.99".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Pah Ute	48 24 22.08	228 10 35.43	4.6802818
Sunday	95 25 22.55	275 04 45.81	4.7274706
Big Meadows	124 18 30.89	304 06 42.62	4.5649336

PAH UTE, KERN COUNTY.

The highest peak on the range south of Kernville and about 8 miles east of Havilah. It can be ascended from camp at Rankins in Walker Basin in three hours, from Nick Williams in three hours, or from Cienega in two hours. Water directly under peak one-half mile to southeast, reached by wagon road; then good road to summit.

Station mark: A bronze triangulation tablet cemented in solid rock, above which a cairn 5 feet high was erected.

[Latitude 35° 27' 04.62". Longitude 118° 23' 27.29".]

To station—	Azimuth.	Back azimuth.	Log. distance.
Double	10 25 24.40	190 22 09.83	4.6743668
Old Town	21 22 51.50	201 18 06.13	4.5350191
Breckinridge	89 58 45.66	269 52 04.54	4.2415837
Sunday	154 34 23.72	334 27 38.40	4.6097404
Big Meadows	185 44 06.62	5 46 09.34	4.7234576
Cache	333 09 16.60	153 14 10.77	4.4546164

PAJUELA, KERN COUNTY.

On the first low peak 3 miles east of Cameron station on Southern Pacific Railroad.

Station mark: A bronze triangulation tablet buried in ground, above which was erected a cairn 6 feet high.

[Latitude $35^{\circ} 07' 15.64''$. Longitude $118^{\circ} 17' 38.41''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	
Double	60 34 01.36	240 27 27.11	4.3003508
Old Town	102 31 37.32	282 23 32.31	4.3393768
Cache	199 48 25.51	10 49 57.53	4.0763916
Soledad	327 47 50.69	147 51 29.34	4.2581887

SOLEDAD, KERN COUNTY.

A butte 7 miles southeast of Mohave, around the eastern end of which the Southern Pacific Railroad passes. It can be best reached by road to the "Grey Eagle" mine and then by trail to summit.

Station mark: A bronze triangulation tablet cemented in solid rock, above which a cairn 10 feet high was erected.

[Latitude $34^{\circ} 58' 57.89''$. Longitude $118^{\circ} 11' 17.68''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	
Odell	4 57 13.63	184 55 39.21	4.6893126
Libre	47 01 04.14	226 47 46.03	4.6868484
Frazier	72 21 45.60	251 54 58.97	4.8748714
Double	101 35 48.84	281 25 36.86	4.4410062
Pajuela	147 51 29.34	327 47 50.69	4.2581887
Cache	168 06 58.16	348 04 51.10	4.4335946

SUNDAY, KERN COUNTY.

The highest peak in Greenhorn Mountains, on the west side of the Kern River, at head of Cedar Creek, about 18 miles northwest of Kernville. Camp at Meadow, 800 feet below summit, on the south-east side.

Station mark: A bronze triangulation tablet cemented in granite ledge, over which was erected a cairn 5 feet high.

[Latitude $35^{\circ} 46' 57.15''$. Longitude $118^{\circ} 35' 03.31''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Moses	171 05 10.17	351 01 46.57	4.7462795
Florence	182 31 19.39	2 32 31.46	4.8406527
Big Meadows	285 12 24.95	55 21 15.81	4.4420184
Pah Ute	334 27 38.40	154 34 23.72	4.6097404
Breckinridge	359 49 35.35	179 49 37.92	4.5655670

ODELL, LOS ANGELES COUNTY.

On the western end of a long, flat ridge, 6 miles north-northwest of Acton and one-fifth mile north-northwest of Mr. Odell's house. The ridge is nearly free from brush, and can be easily ascended on horseback.

Station mark: A copper bolt sunk in the solid, outcropping ledge, above which a cairn 8 feet high and 8 feet in diameter was erected.

[Latitude, $34^{\circ} 32' 36.87''$. Longitude, $118^{\circ} 14' 03.28''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Frazier	111 07 16.02	290 42 12.40	4.8577810
Liebre	116 22 54.38	296 11 14.73	4.5440811
Soledad	184 55 39.21	4 57 13.63	4.6898126

OLANCHA, INYO AND TULARE COUNTIES.

(Not occupied.)

The highest peak on range southwest of Owen Lake.

Station mark: A cairn, probably erected by the Wheeler survey.

[Latitude, $36^{\circ} 15' 55.53''$. Longitude $118^{\circ} 07' 03.05''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Big Meadows	27 10 16.18	207 02 40.29	4.6282473
Sunday	38 16 38.85	218 00 10.70	4.8932895
Florence	112 03 17.94	291 47 54.89	4.6220458

WHITNEY, INYO AND TULARE COUNTIES.

The highest peak in the United States proper, at head of Kern River, about 20 miles southwest of Independence.

Station mark: A cairn, probably erected by the Wheeler survey.

[Latitude $36^{\circ} 34' 48.57''$. Longitude $118^{\circ} 17' 29.57''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Big Meadows.....	2 54 47.92	182 53 20.79	4.8614282
Sunday	16 40 58.82	196 30 33.52	4.9646686
Florence	50 32 52.02	230 29 38.13	4.4779257
Wauguyhe.....	248 55 26.49	69 38 02.11	5.0540514

BIG MEADOWS, TULARE COUNTY.

The highest point on range between Kern River and South Fork of Kern River, about 25 miles northeast of Kernville along the Mount Whitney trail.

Station mark: A bronze triangulation tablet cemented in a large boulder, over which is erected a cairn 6 feet high.

[Latitude $35^{\circ} 55' 28.50''$. Longitude $118^{\circ} 19' 56.92''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Pah Ute.....	5 48 09.34	185 44 06.62	4.7224576
Breckinridge	23 25 23.77	208 16 37.60	4.7575669
Sunday	55 21 15.81	285 12 24.95	4.4420184
Moses.....	141 33 04.62	321 20 46.63	4.7013414
Florence	159 55 59.28	839 48 16.62	4.7554015

FLORENCE, TULARE COUNTY.

Mount Florence is the highest point east of Farewell Gap, about 6 miles southeast of "Mineral King," at headwaters of Middle Fork of Kawesh and Little Kern rivers.

Station mark: A bronze triangulation tablet cemented in solid rock, surmounted by a cairn 6 feet high.

[Latitude, $36^{\circ} 24' 22.96''$. Longitude, $118^{\circ} 33' 00.95''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ' "	° ' "	<i>Meters.</i>
Sunday	2 32 31.46	182 31 19.39	4.8406527
Moses.....	30 35 55.38	219 31 17.76	4.2635024
Big Baldy.....	134 54 42.41	314 42 51.70	4.6217913
Silliman	153 37 10.01	333 31 56.75	4.4687506
Big Meadows.....	339 48 16.62	159 55 59.28	4.7554015

MOSES, TULARE COUNTY.

A high rocky point between headwaters of North Fork and Middle Fork of Tulare River, about 3 miles northeast of Frazier's mill. Ascended from camp at south end of Long Meadows in two hours—one hour on foot.

Station mark: A bronze triangulation tablet cemented in solid rock, surmounted by a cairn 6 feet high.

[Latitude, $36^{\circ} 16' 44.12''$. Longitude, $118^{\circ} 40' 49.45''$.]

To station—	Azimuth.	Back azimuth.	Log. distance.
Big Baldy	157 35 04.44	337 27 53.29	4.6742414
Silliman	177 58 02.20	357 57 27.82	4.6076826
Florence	219 31 17.76	39 35 55.38	4.2635024
Big Meadows	321 20 46.63	141 33 04.62	4.7013414
Sunday	351 01 46.57	171 05 10.17	4.7462795

PRIMARY TRAVERSE.

Primary traverse for the control of the Sacramento fifteen-minute quadrangle, based upon the position of the dome of the State capitol, (United States standard datum), was run by Mr. Charles F. Urquhart, topographer, in three circuits, as follows:

From Sacramento, eastward along Central Pacific Railway to Fair-oaks; thence northward via highways to Roseville; thence returning to Sacramento via Central Pacific Railway.

From near Salisbury on Central Pacific Railway, south to about parallel $38^{\circ} 30'$; thence westward via highways to about meridian $121^{\circ} 30'$; thence northward to Sacramento.

From a point about $1\frac{1}{2}$ miles northeast of State capitol, westward via highways to Sacramento-Sutter county line; thence eastward to Roseville.

Geographic positions along Central Pacific Railway from Sacramento to Fairoaks.

Station.	Latitude.	Longitude.
Sacramento, State capitol dome	38 34 37.4	121 29 34.3
Sacramento, Y street, 47 feet north from north meridian monument	38 38 35.2	121 28 59.3
Sacramento, corner Thirty-first and R streets, crossing of Thirty-first street	38 33 51.6	121 28 05.9
Homestead, road crossing at	38 33 47.6	121 27 51.4
Brighton station	38 33 07.0	121 25 23.4
Perkins station	38 32 49.5	121 23 57.1
Mahew, opposite railroad building	38 33 54.0	121 21 03.1
Mahew, road crossing at	38 33 55.9	121 20 59.2
Mills station	38 35 10.9	121 18 28.5
Mills station, road crossing at	38 35 11.7	121 18 26.8
Fairoaks, junction of spur line to	38 36 28.0	121 15 52.7
Soudan, road crossing at	38 36 09.5	121 16 46.6
Fairoaks station	38 38 01.6	121 15 43.0

Geographic positions along highways from Fairoaks to Roseville.

Station.	Latitude.	Longitude.
Fairoaks colony	38 38 39.7	121 16 13.3
Fairoaks and Roseville road, intersection of road from Mr. Cunningham's house with west boundary of colony	38 39 11.2	121 17 28.9
Three Corners, road east to Orangevale and north to Roseville	38 40 43.1	121 17 22.1
Auburn road, crossing of	38 41 42.1	121 17 22.3
Schoolhouse, point opposite	38 41 47.6	121 17 22.4
County-line monument, Sacramento and Placer counties	38 43 19.1	121 17 22.9
Road west	38 43 20.8	121 17 22.9
County-line monument, Sacramento and Placer counties	38 43 21.3	121 17 56.0
Road east, near railroad	38 44 12.9	121 17 55.8

Geographic positions along Central Pacific Railroad from Roseville to Sacramento.

Station.	Latitude.	Longitude.
Crossing of road to Ezra Dudley's residence	38 44 17.0	121 17 56.4
County-line monument, Sacramento and Placer counties	38 43 25.0	121 18 46.1
Antelope, road crossing at	38 42 32.2	121 19 43.3
Road crossing	38 40 38.5	121 21 46.7
Ben Ali, first road crossing northeast of	38 37 20.4	121 25 21.6
Ben Ali (box car)	38 37 17.6	121 25 24.6
Roseville and Sacramento road, crossing of	38 36 41.4	121 26 03.8
Roseville, Marysville, and Sacramento roads. junction of	38 36 41.6	121 26 54.9
Long bridge over overflow, northeast end of	38 36 10.2	121 27 57.5
Sacramento, Twelfth street crossing, north side Central Pacific Rwy. tracks	38 35 20.5	121 29 10.3
Sacramento, corner Thirteenth and N streets	38 34 30.6	121 29 25.3

Geographic positions along highways south from point near Salisbury to about parallel 38° 30', thence westward along highways to about meridian 121° 30', thence northward to Sacramento.

Station.	Latitude.	Longitude.
Intersection of Mills and Whiterock road with road from Salisbury	38 35 28.0	121 15 17.9
Three Corners	38 33 35.9	121 15 30.4
Crossing on old Jackson road	38 31 42.4	121 15 37.4
Crossing new Jackson road	38 30 36.9	121 15 36.9
Road corner, leave new Jackson road	38 30 51.4	121 16 42.8
Road crossing at schoolhouse	38 30 40.3	121 17 49.7
Road crossing to Walsh	38 30 40.4	121 20 03.0
Road crossing	38 30 40.2	121 21 42.9
Central Pacific Rwy. crossing	38 30 39.5	121 24 04.9
Upper Stockton road crossing (Dadin's blacksmith shop)	38 30 39.2	121 26 05.9
Lower Stockton road crossing	38 30 38.8	121 27 58.2
Road crossing (thence north)	38 30 38.5	121 28 56.2
Road crossing	38 32 24.7	121 28 57.2

Geographic positions along highways from northeast end of long bridge over overflow, north to county line, thence east to Roseville.

Station.	Latitude.	Longitude.
Three Corners, river road turns west	38 36 22.2	121 28 29.6
Road northeast	38 37 51.9	121 28 28.8
Road west (near Mr. Schieber's house)	38 39 25.0	121 28 28.6
Opposite Six-mile house	38 39 50.6	121 28 59.7
Opposite Mr. Cippa's barnyard	38 40 32.3	121 29 00.1
Road at saloon	38 42 01.2	121 29 00.8
County line monument, Sacramento and Sutter counties	38 44 05.7	121 29 00.7
Three Corners, on Marysville and Roseville road	38 45 06.2	121 29 01.2
County line crossing Sutter and Placer counties	38 45 06.8	121 28 08.3
Road south	38 45 06.7	121 26 17.9
Lane south	38 45 07.1	121 23 30.8
Road south, telephone line	38 45 07.1	121 21 51.3
Top of small hill, opposite old house	38 45 07.6	121 19 19.5
Roseville station, semaphore post at	38 45 06.0	121 16 57.3



INDEX.

A.		Page.		Page.	
<i>Æneas station, Montana, description and position of</i>		102		<i>Baldwin, Ohio, position of</i>	50
<i>Ahern, J. work of</i>		130		<i>Baltimore, Md., position of</i>	86
<i>Alabama, positions of points in</i>		68-70		<i>Baltimore and Ohio Railroad, positions along</i>	42-43
<i>Alexander, Ala., position of</i>		69		<i>Banner station, Wyoming, description and position of</i>	96
<i>Alger, Ohio, position of</i>		50		<i>Baptiste station, Montana, description and position of</i>	102
<i>Alias station, Montana, description and position of</i>		121		<i>Battle station, Wyoming, description and position of</i>	84
<i>Alum Creek, Ohio, position of</i>		50		<i>Batson, Ohio, position of</i>	50
<i>Anabel, Mo., position of</i>		77		<i>Beck station, Pennsylvania, description and position of</i>	29-30
<i>Anderson, Mich., position of</i>		74		<i>Beech, Mich., position of</i>	75
<i>Anita station, Colorado, description and position of</i>		91		<i>Beech Plains Church station, New York, description and position of</i>	19
<i>Ann Arbor, Mich., position of</i>		74		<i>Belgium, Wis., position of</i>	76
<i>Ann Arbor Railroad, positions along</i>		74		<i>Ben Ali, Cal., position of</i>	154
<i>Antelope, Cal., position of</i>		154		<i>Benton Ridge, Ohio, position of</i>	52
<i>Antoine Ark., position of</i>		80		<i>Berrett, Md., position of</i>	38
<i>Arab station, New York, description and position of</i>		19		<i>Bethel, Ohio, position of</i>	62
<i>Archbold, Ohio, position of</i>		48		<i>Bettsville, Ohio, position of</i>	54
<i>Arizona, descriptions of triangulation stations in</i>		130-135		<i>Big Four Railway, positions along, in Illinois</i>	72
<i>Arkansas, positions of points in</i>		80		<i>Big Meadows station, California, description and position of</i>	151
<i>Ashland, Nebr., position of</i>		82		<i>Big Walnut Creek, Ohio, positions along</i>	59, 60
<i>Ash Peak station, Arizona, description and position of</i>		131		<i>Blachleyville, Ohio, position of</i>	44
<i>Atlanta, Mo., position of</i>		77		<i>Bloomville, Ohio, position of</i>	63
<i>Atlantic Coast Line Railroad, positions along</i>		38, 40		<i>Blue Ridge station, New York, description and position of</i>	14
<i>Atlantic section of topography, detailed report of work of</i>		12-45		<i>Boundary 373 station, Montana, description and position of</i>	122
<i>summary of published results in</i>		11		<i>Bowser station, Pennsylvania, description and position of</i>	35
<i>Aubrey, Ala., position of</i>		69		<i>Breckinridge station, California, description and position of</i>	146
<i>Auburn, Ala., position of</i>		70		<i>Bridge station, California, description and position of</i>	142
<i>Auburn, N. C. position of</i>		39		<i>Brider station, Wyoming, description and position of</i>	84
<i>Avis, Ohio, position of</i>		51		<i>Brighton, Cal. position of</i>	153
<i>Aycocks Mill, N. C., position of</i>		40		<i>Brighton, Ohio, position of</i>	45
<i>Azimuth station, Arizona, description and position of</i>		131		<i>Brocktown, Ark., position of</i>	80
<i>Azimuth station, Colorado, description and position of</i>		91		<i>Broken Sword, Ohio, position of</i>	63
<i>Azimuth station, Wyoming, description and position of</i>		83-94		<i>Brown station, California, description and position of</i>	138-139
<i>Azimuth mark station, Wyoming, description and position of</i>		83		<i>Brownhelm, Ohio, position of</i>	68
				<i>Brushy station, California, description and position of</i>	139
<i>Baker, N. C., position of</i>		39		<i>Bryan, Ohio, position of</i>	48
<i>Baker station, Montana, description and position of</i>		121			
<i>Baldwin, H. L., Jr., work of</i>		98			

Page.	Page.
Bryce station, Arizona, description and position of	131-132
Buck station, New York, description and position of	14-15
Bucyrus, Ohio, position of	64
Bullard station, New Mexico, description and position of	135-136
Bullhead, N. C., position of	40
Buffalo, Wyo., meridian marks at	97-98
Buffalo station, Wyoming, description and position of	94
Burbank, Ohio, position of	42
Burlington and Missouri River Railroad, positions along	81, 82
Burr, Nebr., position of	81
Byron station, California, description and position of	142
C.	
Caborus, Ind., position of	72
Cache station, California, description and position of	147
California, descriptions of triangulation stations in	138-156
positions of points in	152-155
Calmar, Iowa, position of	79
Calvin, Ill., position of	72
Camden, Ohio., position of	45
Campbell, Ala., position of	69
Canton water-tower station, New York, description and position of	19-20
Canyon station, New Mexico, description and position of	136
Carey station, Montana, description and position of	107
Carmi, Ill., position of	72
Carrollton, Md., position of	37
Castalia, Iowa, position of	79
Cathead station, New York, description and position of	15
Catonsville, Md., position of	36
Cedar Creek, Nebr., position of	82
Center station, Arizona, description and position of	130
Centerpoint, Ark., position of	80
Central of Georgia Railway, positions along	69
Central Pacific Railway, positions along	153, 154
Central section of topography, detailed report of work of	46-82
summary of published results in	11
Chapman, R. H., work of	98, 130
Chehaw, Ala., position of	70
Chelsea, Mich., position of	73
Chenowith, Ohio, position of	62
Cheshire, Ohio, position of	60, 65
Chicago, Milwaukee and St. Paul Railway, positions along	79
Chicory station, Pennsylvania, description and position of	26-27
Chief Mountain station, Montana, description and position of	122
Clarence, Mo., position of	77
Cleveland station, Montana, description and position of	123
Clietts, Ala., position of	70
Cliff station, Montana, description and position of	107-108
Cliff station, New Mexico, description and position of	136
Clinton, Mich., position of	73
Clough, Ala., position of	70
Coalbank station, Montana, description and position of	108
Colorado, descriptions of triangulation stations in	91-93
Columbia, Md., position of	36
Columbus, Ohio, position of	59, 65
Cone station, Wyoming, description and position of	94
Conetoe, N. C., position of	41
Connie station, Montana, description and position of	123
Connor, N. C., position of	42
Conover, Iowa, position of	79
Cook, Nebr., position of	81
Cowles, Ala., position of	70
Cowling, Ill., position of	72
Crawford-Marion county line, Ohio, position of	64
Crisp, N. C., position of	41
Criswell, Ohio, position of	51
Cross H station, Wyoming, description and position of	95
Crossville, Ill., position of	72
Cullom, Nebr., position of	82
Cutbank station, Montana, description and position of	123-124
D.	
Dadeville, Ala., position of	66
Daly station, Montana, description and position of	117
Davis station, Pennsylvania, description and position of	30
Dearborn station, Montana, description and position of	108
Decker, Ind., position of	71
Delaware and Union counties, Ohio, position of stone monument between	53
Delaware-Franklin county line, Ohio, position of	65
Delaware-Licking county line, Ohio, position of	60
Delhi, Mich., position of	73
Delight, Ark., position of	80
Delta, Ohio, position of	47
Desaw station, New York, description and position of	12
De Smet station, Wyoming, description and position of	95
Dexter, Mich., position of	73
Diablo station, California, description and position of	142
Divide station, Montana, description and position of	124
Dixonville, N. C., position of	41
Dome station, California, description and position of	145
Double station, California, description and position of	147
Douglas Grove, Wis., position of	76

Page.	Page.		
Nebr., position of	81	G.	
N. C., position of	40	Galbreath station, Montana, description and position of	126
station, Montana, description and position of	125	Gamer station, Montana, description and position of	110
E.		Gannett, S. S., work of	98
ock, N. C., position of	42	Garnett, N. C., position of	89
se station, Montana, description and position of	108-109	Gehanna, Ohio, position of	59
se station, Wyoming, description and position of	84	Genoa, N. C., position of	40
rg station, Pennsylvania, description and position of	27	George station, Wyoming, description and position of	96
n, Ohio, position of	49	Georgesville, Ohio, position of	58
an station, Montana, description and position of	117-118	Gila station, Arizona, description and position of	122
ion, Montana, description and position of	125	Gilboa, Ohio, position of	52
City, Md., position of	36	Gildart station, Montana, description and position of	108
R., work of	46, 53	Girard station, Pennsylvania, description and position of	30-31
ch., position of	75	Glandorf, Ohio, position of	52
station, California, description and position of	145	Glenelg, Md., position of	36
i., Ill., position of	72	Glen Falls, Md., position of	87
lroad, positions along, in Ohio	59	Glen Morris, Md., position of	87
e, Ohio, position of	54	Glenwood, Md., position of	96
N. C., position of	40	Globe, Ariz., positions of points in vicinity of	130
lle, Ind., position of	73	Glyndon, Md., position of	37
lle and Terre Haute Railroad, positions along	71	G. N. station, Montana, description and position of	103-104
Mo., position of	77	Goldhill, Ala., position of	60
F.		Goodwater, Ala., position of	69
s, Cal., position of	153	Gordon station, Montana, description and position of	114
v, Ohio, position of	61	Government station, California, description and position of	144
v station, Montana, description and position of	109-110	Graham station, Arizona, description and position of	182
C., position of	40	Grand Trunk Railway, positions along, in Michigan	74
Madison county line, Ohio, position of	61, 62	Grayville, Ill., position of	72
Pickaway county line, Ohio position of stone monument on	61	Green Spring, Ohio, position of	66
Md., position of	36	Greenwich, Ohio, position of	43, 45
tion, New York, description and position of	20	Greenwood, Nebr., position of	82
, Ohio, position of	52, 57	Greenville station, Wyoming, description and position of	85
, Fort Wayne and Western Railroad, positions along	50-52	Groverhill, Ohio, position of	51
rg, Md., position of	37	Gurdon, Ark., position of	80
tion, New York, description and position of	15	Gurley, Ohio, position of	54
er, N. C., position of	39	Guthrie station, Arizona, description and position of	183
station, Montana, description and position of	125	H.	
hio, position of	65	Hagler, Ohio, position of	62
e station, California, description and position of	151	Hahn station, Colorado, description and position of	92
', Ohio, position of	59	Half Dome station, Montana, description and position of	126
ille, N. C., position of	39	Halls Cross Roads, N. C., position of	38
kinson, Iowa, position of	79	Hamburg, Mich., position of	74
anch, Ind., position of	71	Hamilton station, New York, description and position of	16
elle, astronomic station, Wyoming, description and position of	85	Hannibal, Mo., position of	78
nt, Wis., position of	76	Hannibal and St. Joe Railroad, positions along	77, 78
n, Ala., position of	70	Harrod, Ohio, position of	59
ck, Md., position of	36	Haubstadt, Ind., position of	71
tion, Pennsylvania, description and position of	27	Havelock, Nebr., position of	82

	Page.		Page.
Havens Corners, Ohio, position of.....	59	L.	
Haviland, Ohio, position of.....	51	Lakefork, Ohio, position of.....	44
Hawkins, G. T., work of.....	46, 68	Lake Shore and Michigan Southern Rail-way, positions along.....	46-49
	70, 73, 75, 76, 78, 80	Lakeshore Junction, Wis., position of.....	76
Hayesville, Ohio, position of.....	44	Landslide station, Montana, description and position of.....	127
Hazleton, Ind., position of.....	71	Laplate, Mo., position of.....	76
Heavens station, Montana, description and position of.....	104	Laurel station, California, description and position of.....	145
Hereford, Ohio, position of.....	48	Leal station, California, description and position of.....	139-140
Hessville, Ohio, position of.....	66	Leesburg, Ohio, position of.....	61
Hickman, Nebr., position of.....	81, 82	Lenox station, Montana, description and position of.....	110
High Sharp station, Colorado, description and position of.....	92	Lentner, Mo., position of.....	77
Hilger station, Montana, description and position of.....	110-111	Leonardsburg, Ohio, position of.....	65
Holland, Ohio, position of.....	46	Liberty, Md., position of.....	36
Holland station, Montana, description and position of.....	114-115	Lilly Chapel, Ohio, position of.....	53
Hollins, Ala., position of.....	69	Lima, Ohio, position of.....	59
Homer, Ohio, position of.....	43	Lincoln, Nebr., position of.....	83
Homestead, Cal., position of.....	153	Lincoln station, Montana, description and position of.....	127
Honnold station, Wyoming, description and position of.....	86	Line station, New Mexico, description and position of.....	138-137
Hoskins, Ohio, position of.....	58	Little Blue station, New York, description and position of.....	20
Hunnewell, Mo., position of.....	77	Little River, North Carolina, position of bridge over.....	40
Huntington, Mo., position of.....	78	Livermore station, California, description and position of.....	140
Hunts Cross Roads, N. C., position of....	38	Loachapoka, Ala., position of.....	70
I.		Lodi, Ohio, position of.....	43
Illinois, positions of points in.....	71, 72	Lone Pine station, California, description and position of.....	140
Indiana, positions of points in.....	71, 72, 73	Lorton, Nebr., position of.....	81
Inglefield, Ind., position of.....	71	Loubert Creek, Ohio, position of.....	53
Iowa, positions of points in.....	73-79	Louisville, Nebr., position of.....	82
Iowa-Minnesota State line, positions along.....	79	Louisville and Nashville Railroad, positions along.....	72-73
Iron Mountain Railway, positions along.....	80	Luray, Ohio, position of.....	62
Iron station, New York, description and position of.....	12	M.	
J.		McCarthy station, New York, description and position of.....	21
Jackson Junction, Iowa, position of.....	79	McCormick station, Wyoming, description and position of.....	97
Jacksons Gap, Ala., position of.....	69	McCutchenville, Ohio, position of.....	54
Jacksonville, Mo., position of.....	77	McDonald station, Montana, description and position of.....	115-116
Jamaica, Nebr., position of.....	82	McDowell station, Pennsylvania, description and position of.....	32
Jasper Mills, Ohio, position of.....	61	McGill, Ohio, position of.....	50
Johannesburg station, California, description and position of.....	145	McGuffey, Ohio, position of.....	59
Johnstown, N. Y., meridian marks at.....	26	McKinney station, Wyoming, description and position of.....	95
Johnstown, Ohio, position of.....	61	McLeod station, Montana, description and position of.....	116
Jones, O., work of.....	38	McNair, E. L.....	12, 36, 42
K.		Macon, Mo., position of.....	77
Kamas station, Montana, description and position of.....	115	Madison and Union counties, Ohio, position of stone monument between.....	53
Keen, Ill., position of.....	72	Mahew, Cal., position of.....	153
Kellyton, Ala., position of.....	69	Mansfield, Ohio, position of.....	43
Kempton, Ohio, position of.....	59	Marion, Ohio, position of.....	64
Kenton, Ohio, position of.....	56	Marion-Morrow county line, Ohio, position of.....	64
Kephart station, Pennsylvania, description and position of.....	31	Maryland, positions of points in.....	36-37
Kephart Tree station, Pennsylvania, description and position of.....	31		
Kildare station, New York, description and position of.....	31		
King, Ind., position of.....	13		
Kirkpatrick, Ohio, position of.....	71		
Kirksville, Mo., position of.....	64		
Kyler station, Pennsylvania, description and position of.....	76		
	32		

Page.	Page.		
Maryland-Pennsylvania boundary line, positions along.....	87	Nashville, N. C., position of	38
Maturango station, California, position of.....	144	Natanes station, Arizona, description and position of	130-131
Maumee, Ill., position of	72	Nebraska, positions of points in.....	80-82
Maya Cross Roads, N. C., position of	39	Nebraska City, Nebr., position of	81
Medicine Bow station, Wyoming, description and position of	86	Needle station, Wyoming, description and position of	87
Mequon, Wis., position of	76	Nepper station, Pennsylvania, description and position of	88
Michigan, positions of points in	73-75	Neuse, N. C., position of	89
Michigan Central Railroad, positions along.....	73	Neuse River, North Carolina, position of	89
Milepost 145, Colorado-Wyoming State line, description and position of	98	Nevada station, Montana, description and position of	100
Milepost 163, Colorado-Wyoming State line, description and position of	98	New Holland, Ohio, position of	61
Milk River station, Montana, description and position of	127	New Hudson, Mich., position of	74
Millard, Mo., position of	76	New Mexico, descriptions of triangulation stations in	135-138
Millbrook, N. C., position of	39	New York, descriptions of triangulation stations in	12-26
Millbrook, Ohio, position of	44	Nierny station, New York, description and position of	21-22
Mill Creek station, New York, description and position of	25-26	North Base station, Montana, description and position of	118
Miller station, Montana, description and position of	116-117	North Carolina, positions of points in	38-42
Mills, Cal., position of	153	North East station, Arizona, description and position of	130
Milstead, Ala., position of	70	North Howell, Ind., position of	72
Milwaukee, Wis., position of	76	Norwalk, Ohio, position of	67
Missouri, positions of points in	76-78	Norwood station, New York, description and position of	22
Missouri, Kansas and Texas Railway, positions along	78	Notasulga, Ala., position of	70
Missouri Pacific Railway, positions along	81	Novi, Mich., position of	75
Mitchell station, Montana, description and position of	111-112	O.	
Mocho station, California, description and position of	143-144	Oak, Mich., position of	75
Moffits, Ohio, position of	52	Oak Harbor, Ohio, position of	66
Mogollon station, New Mexico, description and position of	137-138	Oak Hill station, New York, description and position of	19
Monroe, Mo., position of	77	Observation station, Montana, description and position of	123
Monroeville, Ohio, position of	67	Odell station, California, description and position of	150
Montana, descriptions of triangulation stations in	98-128	Ohio, positions of points in	42-48
Montgomery, Ala., position of	70	Ohio-Indiana State line, positions along	49-50
Monture station, Montana, description and position of	99	Ohio-Michigan State line, position of	57
Moosehead station, New York, description and position of	21	Okolona, Ark., position of	80
Morenci station, Arizona, description and position of	133	Olancha station, California, description and position of	144, 150
Morgan Run, Md., position of	36	Old Sparta, N. C., position of	41
Morrisdale station, Pennsylvania, description and position of	33	Old Town station, California, description and position of	147-148
Moses station, California, description and position of	152	Old Yankeeetown, Ohio, position of	61
Moss station, Montana, description and position of	104-105	Omaha Junction, Nebr., position of	82
Mount Carmel, Ill., position of	71	Opelika, Ala., position of	70
Mount Helena station, Montana, description and position of	112	Ormondsville, N. C., position of	41
Mount Meigs, Ala., position of	70	Ossian, Iowa, position of	79
Mount Steele station, Wyoming, description and position of	86-87	Ottawa, Ohio, position of	52
Mount Sterling, Ohio, position of	53, 61, 62	Owens station, California, description and position of	148
Mount Vernon, Ind., position of	72	P.	
Murfreesboro, Ark., position of	80	Pacific section of topography, detailed report of work of	138-156
		summary of published results in	11
		Pah Ute station, California, description and position of	148

	Page.		Page.
Paint Creek, Ohio, position of bridge over.	62	Red station, California, description and position of.	146
Pajuela station, California, description and position of.	149	Rensselaer, Mo., position of.	78
Panama, Nebr., position of.	81	Richwood, Ohio, position of.	53
Panther station, New York, description and position of.	22-23	Ridge Spring, N. C., position of.	41
Pardee station, Pennsylvania, description and position of.	33-34	Ridgeville, Ohio, position of.	58
Parkdale, Ala., position of.	69	Ridgeway, Iowa, position of.	79
Patapsco, Md., position of.	37	Riverside station, Wyoming, description and position of.	88-89
Patoka, Ind., position of.	71	Roads station, New York, description and position of.	25
Patterson station, Pennsylvania, description and position of.	34	Robertson station, Montana, description and position of.	128
Patuxent River, Maryland, position of middle branch of.	36	Rocky station, Montana, description and position of.	128-129
Pelham station, Wyoming, description and position of.	87-88	Rocky Mountain section of topography, detailed report of work of.	83-138
Pennsylvania, descriptions of triangulation stations in.	26-35	summary of published results in.	11
Pennsylvania-Maryland boundary line, positions along.	37	Rogers station, New York, description and position of.	23
Pentagon station, Montana, description and position of.	112	Rome, Ohio, position of.	60
Pere Marquette Railroad, positions along.	75	Rose, N. C., position of.	40
Perkins, Cal., position of.	153	Roselmo, Ohio, position of.	51
Perkins, E. T., work of.	146	Roseville, Cal., position of.	155
Petersburg, Ohio, position of.	44	Ross, Ala., position of.	69
Pickaway and Fayette counties, Ohio, position of road on line of.	61	Ross-Pickaway county line, Ohio, position of.	61
Pikeville, N. C., position of.	40	Rumley, Ohio, position of.	43
Pima Church station, Arizona, description and position of.	133	Rushton, Mich., position of.	74
Pinckney, Mich., position of.	74		S.
Pinelevel, N. C., position of.	40	Sacandaga station, New York, description and position of.	13
Pinnacle station, New York, description and position of.	13	Sacramento, Cal., position of.	153, 154
Plano, Ohio, position of.	61	Sage station, Wyoming, description and position of.	89
Platte station, Wyoming, description and position of.	88	St. James, Ind., position of.	71
Pleasant Grove, Ohio, position of.	61	St. Mary station, Montana, description and position of.	118-119
Pleasant station, New Mexico, description and position of.	138	St. Mary station, Wyoming, description and position of.	89
Plymouth, Mich., position of.	75	St. Phillips, Ind., position of.	72
Polk, Ohio, position of.	44	Sandusky River, Ohio, position of.	54
Port Washington, Wis., position of.	76	Saratoga station, Wyoming, description and position of.	90
Post, W. S., work of.	93	Scapegoat station, Montana, description and position of.	113
Postville, Iowa, position of.	79	Schrodt, Ill., position of.	72
Potsdam Presbyterian Church station, New York, description and position of.	23	Scio, Mich., position of.	73
Prairie Dog station, Wyoming, description and position of.	71	Scratchgravel station, Montana, description and position of.	113
Princeton, Ind., position of.	40	Seaboard Air Line Railway, positions along.	39
Princeton, N. C., position of.	53	Secho station, New Mexico, description and position of.	137
Prospect, Ohio, position of.	Q.	Sedalia, Ohio, position of.	62
Quigg station, Montana, description and position of.	106-107	Selma, N. C., position of.	40
	R.	Shannon station, Arizona, description and position of.	134
Raleigh, N. C., position of.	39	Sharp station, Wyoming, description and position of.	90
Randsburg mining district, descriptions and positions of stations in.	144-146	Shellbina, Mo., position of.	77
Range, Ohio, position of.	62	Shell station, Wyoming, description and position of.	96
Rawlins station, Wyoming, description and position of.	88	Shenandoah, Ohio, position of.	43

Page.	
station, Pennsylvania, description and position of	28
e, Ohio, position of	68
ila, position of	70
la., position of	69
rest Reserve, descriptions and sitions of stations in	148-152
station, Montana, description d position of	100
tion, Montana, description and sition of	129
Ark., position of	80
N. C., position of	41
station, California, description d position of	149
al., position of	153
therst, Ohio, position of	68
re station, Montana, description d position of	119
d, Nebr., position of	82
idit, Ohio, position of	60
Railway, positions along, in	
orth Carolina	39-40
an, Mich., position of	74
skymount, N. C., position of	38
station, Pennsylvania, descrip-n and position of	34-35
r station, New York, descrip-n and position of	16
nd., position of	71
ch., position of	75
ion, New York, description and sition of	24
station, Moutana, description d position of	105
station, Montana, description d position of	101
station, New York, descrip-n d position of	13
Ohio, position cf	48
it, Ala., position of	69
oh, Ohio, position of	61
Ohio, position of	43, 44
Ohio, position of	60
station, California, descrip-n d position of	149-150
ion, California, descrip-n and sition of	141
tion, Arizona, descrip-n and sition of	134
tion, Montana, descrip-n and sition of	105-106
Ohio, position of	47
tion, Pennsylvania, descrip-n d position of	28
t, Ala., position of	69
T.	
. C., position of	42
a bridge, Alabama, position of	69
Md., position of	37
, N. C., position of	38
, work of	38, 42
t, Mich., position of	73
station, California, position of	144
station, Pennsylvania, descrip-n and position of	28-29
Thompson, A. H., work of	98
Three Corners, Cal., position of	153, 154, 155
Three Point station, Wyoming, descrip-tion and position of	90
Tipton, Ohio, position of	51
Toledo, Ohio, position of	46
Tomany station, New York, descrip-tion and position of	16-17
Townsend, Ohio, position of	45, 67
Trammells, Ala., position of	60
Trenouth station, California, descrip-tion and position of	141
Triadelphia, Md., position of	36
Triplets station, Arizona, descrip-n and position of	134-135
Turnbull station, Arizona, descrip-tion and position of	135
Tweedy, Frank, work of	83, 93
Twin Lake No. 1 station, New York, descrip-tion and position of	17
Twin Lake No. 2 station, New York, descrip-tion and position of	17-18
U.	
Ula, Wis., position of	76
Union Pacific Railroad, positions on, in	
Nebraska	82
Upton, Ind., position of	72
Urquhart, C. F., work of	138, 146, 152
V.	
Vanlue, Ohio, position of	55, 56
Vincennes, Ind., position of	71
Vulture station, Montana, descrip-n and position of	106
W.	
Wabash Railroad, positions along	76-77
Wakeman, Ohio, position of	68
Walls station, Pennsylvania, descrip-tion and position of	35
Ward (1) station, Montana, descrip-tion and position of	119-120
Ward (2) station, Montana, descrip-tion and position of	120
Washington Court-House, Ohio, position of	61
Waterloo, Ohio, position of	61
Watkins, Ohio, position of	53
Wauseon, Ohio, position of	47
Waverly, Ala., position of	69
Waverly, Nebr., position of	82
Weils, N. C., position of	40
Wellington, Ohio, position of	45
Wess station, Pennsylvania, descrip-tion and position of	29
West Base station, Montana, descrip-tion and position of	109
West Base station, Wyoming, descrip-tion and position of	90-91
West Creek No. 1 station, New York, descrip-tion and position of	18
West Creek No. 2 station, New York, descrip-tion and position of	18
West Detroit, Mich., position of	75

INDEX.

Page.	Page.		
Western Maryland Railroad, positions along.....	87	Wiedeman station, California, description and position of.....	143
Western Railway of Alabama, positions along.....	70	Willow station, Montana, description and position of.....	120-121
Westfield, Ohio, position of.....	64	Wilson, N. C., position of.....	41
Westminster, Md., position of.....	37	Wilson Mills, N. C., position of.....	39
Westminster, Ohio, position of.....	59	Winsor, T., work of.....	130
Wheeler station, New York, description and position of.....	24	Wisconsin, positions of points in.....	75-76
Whitefish Bay, Wis., position of.....	76	Woodland, Ohio, position of.....	53
Whitehead station, Colorado, description and position of.....	24-25	Worthington, Ohio, position of.....	53, 65
White Hill station, New York, description and position of.....	114	Wrightsville, Ohio, position of.....	53
Whiteridge station, Montana, description and position of.....	74	Wyatt, N. C., position of.....	39
Whitmore, Mich., position of.....		Wyoming, descriptions of triangulation stations in.....	83-91, 93-97
Whitney station, California, description and position of.....		Z.	
Whitneys, N. C., position of.....	150	Zirkel station, Colorado, description and position of.....	93
	40	Zuber, Ala., position of.....	69

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T E S T S

FOR

GOLD AND SILVER IN SHALES FROM WESTERN KANSAS

BY

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CONTENTS.

	Page.
Introduction	5
Field work	6
Location	6
Topographic features and drainage.....	6
Geological features	7
Cretaceous rocks.....	7
Niobrara group.....	8
Benton group.....	8
Pleistocene rocks	9
Sampling and assaying	9
Sampling	9
Preparation of sample for assaying	12
Methods of assay	13
Results of assays	14
Summary and conclusions	18
Index	21

TESTS FOR GOLD AND SILVER IN SHALES FROM WESTERN KANSAS.

By WALDEMAR LINDGREN.

INTRODUCTION.

The assertion that certain clay shales of western Kansas contain gold and silver dates back about seven years. In 1895 a company of men, among them a certain H. H. Artz, sunk a shaft near Smoky Hill River, in Trego County, prospecting for zinc. It is stated that some indications of this metal were found, but of more importance was the announcement that the soft clay shales encountered contained a notable percentage of gold. It soon became known that the same clay shales extended through a large part of Ellis County and were especially well exposed in the bluffs along Smoky Hill River in the southern part of that county. A great number of assays of these shales were made by different persons, and a large percentage of the samples was said to contain gold and silver. The asserted amounts vary considerably. Dr. J. T. Lovewell, of Topeka, in a paper read before the Kansas Academy of Science,^a stated that he had made many hundreds of assays and supposed that the clay had average values of \$2 to \$3 per ton in gold and silver, the latter metal always accompanying the gold. One series of 100 assays gave an average of more than \$10 per ton. Dr. Ernst Fahrig, of Philadelphia,^b obtained from actual mill runs in an experimental plant an average of \$2.80 per ton. One of these runs yielded 2.6 ounces silver and \$1.36 gold per ton, and another of them gave an aggregate value of \$6.75 per ton. The Kansas Pioneer Gold Shale Company, advertising their stock in the principal papers of St. Louis, Chicago, and New York, state the value as \$8 to \$10 per ton, and compute the wealth contained in one acre of shales to be \$5,250,000. Others, among them Prof. E. Haworth, of the Kansas State University, have denied that the shales contain gold in notable quantities.^c

The statements of tenor obtained by assays are usually accompanied by the explanation that the values are extremely irregular, different assays from the same carefully mixed pulp giving widely differing results.

^a Topeka Semiweekly Capital, January 3, 1902.

^b Kansas Daily Capital, Topeka, May 3, 1902.

^c Kansas Semiweekly Capital, Topeka, June 6, 1902. Mineral Resources of Kansas for 1898, Lawrence, Kans., 1899.

It was not long before mills were erected to extract the values from the clay shale. In 1900 a company was formed and erected a mill on Smoky Hill River, 14 miles west-southwest of Hays. Some kind of a chloridizing process was to be used, but no run was ever made, the superintendent and owner of the process, W. F. Miller, absenting himself unexpectedly before actual work had begun. In 1901 a smaller experimental mill was built near the works just mentioned by Mr. A. G. Gage, who used a variation of the cyanide process, and claimed to have extracted some gold during a series of short runs. In the spring of 1902 the Kansas Pioneer Gold Shale Company built a mill using the same process and supposed to handle 100 tons per day. This mill, which is located 11 miles southwest of Hays, on Smoky Hill River, had just started crushing and leaching in May, 1902. Finally, during the same month, a company called the Fahrig Mining and Milling Company was organized in Topeka for the purpose of constructing and operating a 100-ton mill on Smoky Hill River. The Fahrig process consists in treating the ore with a salt of unrevealed composition and in precipitating the gold and silver by electrolytic methods.

FIELD WORK.

The investigation of the Kansas shale deposits was undertaken by the United States Geological Survey in May, 1902. The actual work in the field occupied eight days, from May 12 to May 20, and was carried on from Hays as a base.

LOCATION.

Although attention was first drawn to the shales in question through prospecting work in Trego County, all the later developments have taken place in Ellis County, adjoining Trego County on the east. Ellis is one of the west-central counties of Kansas. Its county seat, Hays, is located on the line of the Union Pacific Railroad, 272 miles west of Kansas City. Although near the western limit of the "rain belt," the county produces much wheat and supports a numerous and well-to-do farming population.

TOPOGRAPHIC FEATURES AND DRAINAGE.

The region is drained by Smoky Hill River, which has its headwaters in eastern Colorado and flows through the southern part of Trego and Ellis counties almost due east to its junction with the Saline River. In Ellis County Saline River flows parallel to and 25 miles north of Smoky Hill River. Big Creek traverses Ellis County diagonally, flowing southeasterly to its junction with Smoky Hill River. As may be expected of a stream heading in an arid country, Smoky Hill River sometimes runs dry. After heavy rains it rises rapidly and is often unfordable.

The general relief is that of a rolling, gently undulating country,

through which the rivers have cut well-defined though not very deep trenches. The elevation at Hays is 2,000 feet. Along Smoky Hill River south of Hays elevations range from 1,900 to 2,000 feet. Smooth, grassy hills rise between Big Creek and Smoky Hill River to 2,200 and 2,300 feet, and to somewhat less elevation between Big Creek and the Saline. East of Hays still more gentle outlines prevail, the divide rising little more than 100 feet above the main streams. The highest elevations, 2,400 feet, are in the rough hills south of Smoky Hill River, about 20 miles west-southwest of Hays.

Smoky Hill River flows in a sandy bed rarely more than a few hundred feet in width. The gentle curves of the stream are marked by steep bluffs, 20 to 80 feet high, on the convex side and moderate slopes on the opposite, concave, side. These bluffs are due to the lateral cutting of the banks by the river.

This part of Kansas is mapped by the United States Geological Survey on a scale of 2 miles to the inch and with a contour interval of 20 feet; the Hays and Ellis quadrangles embrace all points referred to in this paper.

GEOLOGICAL FEATURES.

The geology of this part of Kansas is described in a general way in Volume II of the Report of the University Geological Survey of Kansas. The rocks exposed are sedimentary and of Cretaceous age, excepting the sands and gravels along the river, which, of course, are of much later (Pleistocene) age. The two great divisions of the Cretaceous, the Benton and the Niobrara, cover the whole area. The beds of shale and lime lie nearly horizontal but have a slight north-easterly dip.

CRETACEOUS ROCKS.

Beginning from the top, that part of the Cretaceous column with which we are here concerned is subdivided as follows:^a

<i>Section of Cretaceous rocks in western Kansas.</i>		Feet.
Niobrara group.....	{ Smoky Hill chalk	300
	{ Fort Hays limestone	50
	{ Septaria horizon.	
	{ Blue Hill shale	100
	{ Ostrea shales	150
	{ Fencepost limestone	1
Benton group.....	{ Inoceramus horizon	5
	{ Flagstone	10
	{ Lincoln marble	15
	{ Bituminous shale	30
	Total	661

^aThe divisions here used follow the description by Prof. E. Haworth, Geol. Surv. Kansas, Vol. II, pp. 215-221.

Niobrara group.—The upper member of this group, the Smoky Hill chalk, does not cover notable areas in Ellis County. The Fort Hays limestone, on the contrary, is exposed on the hills south of Hays and also to some extent on the ridge north of that town. The thickness is not over 50 feet. The rock is a yellowish limestone, easily dressed and locally used as building stone. It appears again south of Smoky Hill River, capping the shale in the roughly eroded area 20 miles west-southwest of Hays.

Just below the Fort Hays limestone is a well-marked horizon, in which the shales contain large calcareous concretions (septaria), often large and containing abundant veins and crystallized masses of calcite of different colors ranging from white to dark brown.

Benton group.—A great thickness (200 feet) of shales underlies the Fort Hays limestone. The upper 100 feet are called the Blue Hill shales and are fissile light-gray to dark-gray shales without fossils and containing only small amounts of pyrite and organic matter. These are exposed in the hills west and northeast of Hays. They also outcrop below the same limestone on the south side of Smoky Hill River, 18 miles west-southwest of Hays, and extend far up into the adjoining Trego County along the river. Samples 3, 18, and 19 are from this horizon. The shales forming the bed rock at Hays probably belong in the lower part of this division. Several deep wells sunk 4 and 5 miles east and east-northeast of Hays penetrated nothing but shales to a depth of 200 to 360 feet.

The lower division, called the *Ostrea* shales, is 150 feet thick and covers a large area, especially along Smoky Hill River, from some point in Trego County down to a point south or a little southeasterly of Hays. It is a dark-gray calcareous shale, containing a little pyrite, finely divided and also sometimes in concretions. It also contains an abundance of fossil shells, largely of *Ostrea congesta*; sharks' teeth are also often found. Narrow bands of light-gray or yellowish-gray limestone part the shale at intervals of from 5 to 20 feet. Almost the only good exposures are found along the river banks, on either side, according to the curves of the river. Here the bluffs are from 20 to 60 feet high, and if the rock is not fresh on the surface it takes but little work to obtain unaltered material. Near the top of the bluffs the shales are whitish and decomposed and usually covered with Pleistocene sands.

The shales are almost black when somewhat moist, but have a dark-gray color when dry. They generally appear mottled by minute whitish specks in a darker predominating mass. The weathered outcrops are soft and disintegrate into a clayey soil, breaking up into small flat fragments. When fresh the shale is quite compact, though breaking easily into large flat fragments 2 to 4 inches thick. While the upper Blue Hill shales are poor in calcite, the *Ostrea* shales effervesce readily with acids. When washed in a miner's pan,

the heavy residue consists of calcite grains, a few fragments of quartz, and some scant, well-rounded granules of black iron ores; besides there is always a little extremely fine-grained pyrite. No colors of gold could be detected. Samples 1, 2, and 4 to 14 (see pages 10-12) are from the *Ostrea* shales.

The Lower Benton group contains much more limestone than the upper division. It consists of about 70 feet of alternating shales and limestone, as indicated in the above table. It is exposed in the eastern part of Ellis County, though the identification of its various members is not easy during a rapid traverse of the country. The 50-foot bluffs of shale covered by limestone, on the north bank of Smoky Hill River, 3 miles west of Pfeifer and also at Falkenstein's farm on the south bank, about the same distance from the town mentioned, are believed to belong in this horizon. Samples 15, 16, and 17 are from this horizon. The *Ostrea* shales on Smoky Hill River at a point 14 miles west-southwest of Hays are 250 feet below the Fort Hays limestone, and must consequently be near the bottom of the Upper Benton. The vertical distance from here to the Dakota sandstones below can hardly be more than 100 feet.

PLEISTOCENE ROCKS.

To this most recent time division belong the sands and fine gravels along the bottoms of Smoky Hill River and also covering the low shale bluffs which follow the stream. The material of this terrane is chiefly quartzoze and the grains are remarkably well rounded. By washing the material in a miner's pan a heavy residue of black sand, probably both magnetite and ilmenite, is obtained. These grains also are extremely well rounded. Besides, the sand contains abundant grains of garnet and some epidote; fragments of topaz are also said to occur. A number of pans of this sand was washed near Copeland's road crossing, and in one a very minute color of gold was obtained.

SAMPLING AND ASSAYING.

SAMPLING.

The principal gold-bearing stratum is supposed to be the Benton group, including the *Ostrea* shales and the Blue Hill shales. It is stated that these rocks over practically the whole of the areas in which they occur contain more or less gold and silver, though the metals may be rather irregularly distributed. Samples showing value are claimed to have been obtained in Trego County along Smoky Hill River as far westward as the Benton shales extend, all along Smoky Hill River in Ellis County, and also in Rush County, adjoining on the south.

It is claimed that values have also been found in samples collected near Hays; for instance, in the shales underlying the Fort Hays

limestone 4 miles west of the town, and also in samples collected along Saline River, along which Fort Benton shales are also said to outcrop. All the mills, however, are located on Smoky Hill River southwest of Hays, and from this vicinity have also been taken the by far largest number of assayed samples.

In order to arrive at a reliable conclusion regarding the contents of these shales in precious metals, the samples described below were carefully taken. The method used included, first, the clearing of a convenient exposure to a required depth so as to obtain fresh material. Along the river bluffs the shales are very little altered and fresh rock is comparatively easily found. The required thickness of shale being exposed (usually amounting to from 2 to 4 feet), a sample of from 20 to 30 pounds was broken down on a square of canvas; this material was then reduced to pieces about the size of a walnut, or smaller, and the whole amount was quartered down twice to a weight of from 3 to 5 pounds. It was then put into quart jars and the same securely sealed. The following samples were taken:

Samples collected for assay.

No.	Locality.	Character of material.
1	South side of Smoky Hill River, $3\frac{1}{2}$ miles east of the line dividing Ellis and Trego counties. Small quarry located behind Miller's mill, 20 feet above the river. Exposure 25 feet high. This sample represents the average of 3 feet from floor of quarry up to the lower band of limestone.	Black shale containing some pyrite and divided by two narrow bands of gray limestone.
2	Same as No. 1. This sample represents 3 feet of shale between the two layers of limestone. Above the upper limestone band the shales appear decomposed by surface action.	Dark-gray shale with fossils and some concretions of pyrite.
3	South side of Smoky Hill River, $3\frac{1}{2}$ miles northeast of the southwest corner of Ellis County, and about $2\frac{1}{2}$ miles south of Miller's mill. The horizon is in the Blue Hill shales just below the Fort Hays limestone. The elevation is about 2,250 feet. This sample represents an average thickness of 2 feet.	Thinly laminated gray clay shale with no fossils and but little organic matter.
4	Mouth of gulch emptying into Smoky Hill River from the south, $3\frac{1}{2}$ miles west of the Ellis-Trego county line. This locality is about 200 feet west of Gage's experimental mill. The bluff is here 30 feet high and consists of dark-gray shale divided by two narrow partings of gray lime. The sample represents 3 feet of shales 2 feet above the bed of the gulch.	Dark-gray <i>Ostrea</i> shale with fossils and a little pyrite.

Samples collected for assay—Continued.

No.	Locality.	Character of material.
5	Same as No. 4, 500 feet east of Gage's experimental mill. From small pit in shales at the river level, which showed indication of having been recently blasted. Material for experimental work in Topeka was reported to have been taken from this locality. The exposure showed 6 feet of shale covered by 10 inches of gray lime; above this 6 feet of shale. The sample covered 3 feet of the lower shale.	Fossiliferous <i>Ostrea</i> shales of dark-gray color containing a little pyrite.
6	Same as Nos. 4 and 5, 650 feet east of Gage's experimental mill at base of 30-foot bluff, the upper part more or less decomposed. This sample is an average of 2 feet close to river level.	Dark-gray fossiliferous shale with a little pyrite.
7	Same as No. 6. Average of 3 feet, from 5 to 8 feet above river level.	Dark-gray fossiliferous shale with a little pyrite.
8	South bank of Smoky Hill River, 11 miles southwest of Hays and 1 mile west of Copeland's crossing, in quarry from which material was being extracted for reduction in the Pioneer Company's new mill. The place is less than 100 feet distant from the mill. The bluff is here approximately 30 feet high, the upper 6 feet consisting of well-washed Pleistocene sand. Below this 4 to 6 feet of decomposed shale, below which the quarry has exposed fresh material. The sample is an average of the shale from 8 up to 10 feet above the river.	Dark-gray clay shale, fossiliferous and containing a little pyrite.
9	Same as No. 8. The sample is an average of 2 feet, from 10 to 12 feet above the river level.	Dark-gray fossiliferous shale containing a little pyrite.
10	About 150 feet east of the Pioneer Company's mill. The bluff is here 18 feet high and consists of shale with two or three narrow bands of harder limestone. The sample represents an average of 3 feet, from 5 to 8 feet above the river.	Dark-gray fossiliferous shale.
11	South bank of Smoky Hill River, one-fourth mile west of the Pioneer Company's mill. Twenty-five-foot bank of shale covered by 6 feet of sand and gravel. The sample was taken from blasted cut 2 feet above river level, from shale averaging 2 feet in thickness.	Dark-gray fossiliferous shale with a little iron pyrites.

Samples collected for assay—Continued.

No.	Locality.	Character of material.
12	North bank of Smoky Hill River, 10½ miles southwest of Hays and 300 feet east of Copeland's road crossing. The shale bluff is 30 feet high and contains four smaller bands of dark-gray lime. The sample was taken 4 feet across just above the river.	Dark-gray fossiliferous shale.
13	North bank of Smoky Hill River, 800 feet west of Copeland's road crossing. Shaft 40 feet deep, 15 feet above the river. Filled with water. The sample was carefully picked from east side of dump.	Dark-gray fossiliferous shale.
14	Same as No. 13. Sample picked from west side of dump.	Dark-gray fossiliferous shale.
15	Fifteen miles south-southeast of Hays, in Rush County, 3½ miles west-southwest of the town of Pfeifer. South side of Smoky Hill River, 1 mile south of sharp bend; Baskel's farm on Shelter Creek; bluff opposite house on west side of creek, consisting of 35 feet of thin-bedded shale capped by 12 feet of yellowish limestone.	Dark-gray clay shale with some fossils.
16	Fourteen miles south-southeast of Hays, in Rush County, near boundary line of Ellis, 4 miles west-southwest of Pfeifer. South side of Smoky Hill River at Falkenstein's farm. Bluff 15 feet high from river level of shale with several indistinct limy layers.	Nodules of partly decomposed iron pyrites in shale.
17	Same as No. 16. Average of 2 feet of shale about 8 feet above river level.	Dark-gray shale without much carbonaceous substance.
18	Four and one-half miles west-northwest of Hays and one-fourth mile south of railroad, on farm of J. C. West. Bluff of 50 feet of Blue Hill shale without lime partings, overlain by 20 feet of Fort Hays limestone. Average of 2½ feet near top of shale, 6 feet below limestone.	Dark-gray clay shale without fossils, and with little carbonaceous material.
19	Same as No. 18. Average of 3 feet of shale at foot of bluff.	Dark-gray clay shale.

PREPARATION OF SAMPLES FOR ASSAYING.

The 19 samples described above were sent to Washington, D. C., and further examined. The shale in each lot was crushed, carefully mixed, and quartered down until the last half of the sample amounted to one-half to three-fourths pound. This quantity was finally ground

and sieved through an 80-mesh screen. From this ground material the assays were made.

METHODS OF ASSAY.

The fire assay, as well known, consists in smelting in crucible or scorifier with litharge or lead. The lead absorbs the gold and silver contained in the ore, and this gold and silver remains behind when the lead is driven off by a process of oxidation. For small and moderate amounts of the precious metals this is the most accurate method known, and in skillful hands always gives reliable results. The claim that "the fire assay will not bring out the values" is well known and reiterated to weariness, especially in districts where higher values are desired than nature put in the ores. True enough, the fire assay, like any other analytical operation, requires intelligent care and suitable ingredients. Where there are large amounts of copper, zinc, tellurium, and similar elements in the ore, this assay needs particular attention in order to prevent losses. As in every other quantitative analytical process, there are sources of error in the fire assay. A very small quantity of gold and silver may be lost in the slag in the first smelting. This is generally inappreciable. But in cupelling the lead button there is always a certain loss of silver by absorption by the cupel, much less by volatilization. This loss may amount to several per cent in case of very poor ores and small silver beads, but is then generally practically negligible. The loss of gold during cupellation is ordinarily very much smaller than that of silver, and practically nil. One often hears assertions that the proper values are not brought out by this assay because of the extremely fine distribution of the gold. This is absurd, because the chemical reaction, i. e., the absorption of gold and silver by the lead, takes place practically independent of the mechanical state of the precious metals. If anything, a fine division would be more favorable to their absorption by the lead. In the same category may be put the assertion that the gold in these shales is carried away in the fumes from the crucible.

When one considers that the very minute particles in a low-grade but paying ore, even after fine crushing, are likely to be securely locked up in grains of quartz or other refractory material, it becomes clear that the extraction of gold by chlorine, bromine, or potassium cyanide, which have little effect on these inclosing shells, must be less effective than a fusion. In a fusion with proper fluxes these shells are completely disintegrated, and the molten lead dissolves the precious metal almost entirely. The fire assay is, in fact, used in all cyanide and chlorination works to test ores and tailings.

This statement regarding the wet process also holds good for analytical work. Only in case the ores contain large quantities of gold or silver do the wet methods offer any advantage over fusion and cupellation. Electrolytic quantitative tests of gold and silver are

known, but rarely used,^a offering no advantage over other assays and requiring as much preliminary work in the elimination of other metals as do wet tests by precipitation of the gold by hydrogen sulphide, zinc, oxalic acid, or other means.

The accuracy of the fire assay varies, of course, with the quantity and character of the material, the purity of the reagents, and the skill of the assayer. Dr. W. F. Hillebrand, operating on Leadville rocks, gives 0.005 ounce per ton as the limit of accuracy for silver assays when 4 assay tons of material are used and extremely careful and painstaking work is done.^b Using 2 assay tons in ordinary work, one ought to easily determine quantities of 0.05 ounce of silver ton, and 0.005 ounce, or 10 cents, per ton of gold.

RESULTS OF ASSAYS.

The nineteen samples were first assayed by myself in the laboratory of the Survey. The general proportions of the charge were as follows: One A. T.^c shale, 2 A. T. litharge (contents of silver, 0.005 ounce per ton), 2 A. T. soda, one-half A. T. borax. A layer of litharge was spread over the mixed charge and a layer of salt above this. Samples 1 to 8, inclusive, were assayed with a charge of 2 A. T. shale, and the rest of the fluxes were in the proportion given above. For the remaining numbers 1 A. T. was used. Samples 1, 3, 17, 18, and 19 were assayed without addition of nitrate of soda, and in case the lead button was too large it was scorified down to suitable size. In the remainder of the samples which contained much carbon, niter was added in varying proportions to obtain a convenient button.

For the purpose of collecting the gold, in case no silver was present in the shale, 1.5 to 3 mg. of chemically pure silver was added to each assay, excepting Nos. 1 and 2. This was recovered, minus the minute losses chiefly caused by the absorption of the cupels. No gold was found in any of the samples, though in some of them minute black specks remained after parting the silver buttons. Some of these disappeared on ignition, while others remained, but upon examination with the lens failed to show the luster and color of gold.

The same samples were then assayed in the laboratory of the Survey, by Dr. E. T. Allen, who reports as follows:

I have examined nineteen samples of shale from western Kansas, collected by Mr. Lindgren, and find no gold in any of them.

The samples were assayed in the crucible with about 1 part soda and 2 parts of litharge to 1 part of the ore, and, since most of the shales contained considerable carbonate of calcium, from one-half to 2 parts of borax and some powdered glass were added to make the fusion thinly fluid. Niter was put in to oxidize the excess of carbonaceous matter in all but Nos. 15, 18, and 19. Two A. T. of each sample

^a A. Classen, *Ausgewahlte Methoden der analytischen Chemie*, Braunschweig, 1901, pp. 3, 245, and 254.

^b Mon. U. S. Geol. Survey, Vol. XII, p. 595.

^c A. T. = Assay ton = 29.166 grams.

were taken except Nos. 7, 8, 10, and 12, where only one A. T. was used. Two or 3 mg. of gold-free silver were added to each crucible charge to collect the gold in case the quantity of silver in the shale should prove insufficient. This silver was recovered after cupellation, minus a very small and nearly constant loss, which is always caused by absorption by the cupels, volatilization, etc. When the beads were parted the majority dissolved without residue. In several there remained one or two extremely minute, unweighable black specks. These either disappeared on ignition or else failed to develop the color and luster of gold, though they were examined carefully with a good lens.

In the previous work the added silver might easily have masked the presence of small fractions of an ounce of that metal per ton in the shale. Consequently, a third series of assays of the same samples was undertaken jointly by Dr. E. T. Allen and myself, in order to ascertain whether small quantities of silver were present. The laboratory and all utensils employed were kept scrupulously clean, and we do not believe that there was any possibility of the introduction of gold or silver into the samples except from the litharge. The latter was assayed in duplicate, using 10 A. T. in each charge, with the following result:

Assay of litharge.

Number.	Silver.	Gold.
	<i>Ounce per ton.</i>	
1	0.005	Distinct trace in 10 A. T.
2	0.005	Doubtful trace in 10 A. T.

The particles remaining after parting were carefully examined by a microscope of high power.

The charges for the assays were in the main similar to those indicated above. Two A. T. shale were used in all of the assays except in 11, 15, 16, 17, 18, and 19, in which 1 A. T. was taken. The assay of No. 3 failed and no more material was available. About $1\frac{1}{2}$ parts of litharge to 1 part of shale were used. The cupellation was undertaken with particular care to guard as much as possible against losses from absorption and volatilization. In the cases where weighable buttons were obtained the quantity of silver due to the litharge was subtracted, and the figures given in the following table thus indicate the true amount of silver contained in the shale.

Of six samples marked "repeated" in the table duplicate assays were made. In the duplicates the niter method was avoided and a charge was made as follows: One A. T. ore, 3 A. T. litharge, 2 A. T. soda, one-half A. T. borax. Nos. 14 and 16 were roasted and some argol was added to the charge.

The parting was effected in small glazed porcelain capsules and with very exceptional care. The residue after parting and annealing was examined by a petrographic microscope. In No. 5 we obtained

from 2 A. T. two flakes of gold weighing together 0.01 mg., equaling 0.005 ounce per ton, or a value of 10 cents per ton. In No. 13 several very minute, unweighable flakes of gold were discovered by using high magnifying powers; they could not be recognized by an ordinary lens.

In nearly all of the samples after parting and ignition almost microscopic, unweighable black specks were found. It was determined to subject these to more detailed examination. Under high magnifying power these specks appeared as angular, irregular masses having a dark-gray or black color and submetallic to metallic luster. A few of them were loose aggregates of the same substance with occasional glints of silvery or yellowish luster, which might possibly arise from included particles of gold. The appearance under the microscope is that of graphite. Besides this substance only a few particles of oxide of iron were noted in the residue. A number of the black specks collected were then subjected to the following chemical tests: First, evaporated with aqua regia to dryness, the specks were still visible and seemed unattacked. We next tried burning in a stream of oxygen. The operation was difficult on account of the minute size of the particles, but in two separate trials the specks disappeared upon being treated in a current of that gas. In conclusion, we assert that these dark particles are neither gold nor platinum, though we suspect that in many cases they have been reported as traces of gold. We believe it most probable that these particles are graphitic carbon, contained in the silver. It will probably be objected that carbon could not without change pass through the oxidizing operation of cupellation. Be this as it may, the quantity of carbon obtained was certainly extremely small, and it is a known fact that silver has a decided tendency to unite with carbon under some conditions, as shown by Gmelin-Kraut.^a

Content of gold and silver in samples of shale.

Number.	Silver. ^b <i>Ounce per ton.</i>	Gold.		Total value.
		<i>Ounce per ton.</i>	<i>Per ton.</i>	
1.....	None.	None.
2.....	0.007	None.	\$0.004	
4.....	None.	None.	
5.....	0.017	0.005	.110	
6.....	0.007	None.	.004	
7.....	0.022	None.	.013	
8.....	0.037	None.	.022	
9.....	0.097	None.	.060	

^a Handbuch der Chemie, Vol. III, pt 2.

^b Although the quantities of silver have been given to the third decimal, as calculated from the weights of the beads, it must be understood that quantities below 0.01 or 0.02 ounce per ton are very doubtful under these conditions.

Content of gold and silver in samples of shale—Continued.

Number.	Silver.	Gold.	Total value.
	Ounce per ton.	Ounce per ton.	Per ton.
10.....	Probably none.	None.	-----
10.....	None.	None.	-----
11.....	0.045	None.	\$0.027
11.....	0.030	None.	.018
12.....	Probably none.	None.	-----
12.....	0.030	None.	.018
18.....	0.087	Microscopic trace.	.052
13.....	None.	None.	-----
14.....	0.072	None.	.043
14.....	None.	None.	-----
15.....	0.085	None.	.051
16.....	0.037	None.	.022
16.....	None.	None.	-----
17.....	0.095	None.	.057
18.....	Probably none.	None.	-----
19.....	Probably none.	None.	-----

For further confirmation the samples of most importance—that is, those from the banks of Smoky Hill River, in the vicinity of the mills—were sent to Mr. George E. Roberts, the Director of the Mint, who kindly had them assayed. Nos. 1, 2, 4, 5, 6, 7, and 8 were assayed by Mr. W. F. Bowen, assayer of the mint bureau, and Nos. 9, 10, 11, 12, 13, 14, and 16 were assayed by Mr. Jacob B. Eckfeldt, assayer of the mint in Philadelphia.

Mr. Bowen states that he used 1 A. T. ore to 1 A. T. litharge with necessary fluxes, and that a little niter was added. His results are as follows:

Assays of samples by W. F. Bowen.

Number.	Silver.	Gold.	Total value. ^a
	Oz. per ton.	Oz. per ton.	Per ton.
1.....	0.30	Trace.	\$0.18
2.....	0.20	Trace.	.12
4.....	None.	None.	-----
5.....	0.15	None.	.09
6.....	None.	None.	-----
7.....	0.30	0.05	1.18
8.....	0.15	Trace.	.09

^aColumn added by W. Lindgren.

At the writer's request Mr. Bowen repeated No. 7 on new material from the same original sample. This time he obtained 0.45 ounce silver and no gold; total value, 27 cents.

Mr. Eckfeldt states that he used 1 A. T. ore, 3 A. T. litharge, 2 A. T. soda, and $\frac{1}{2}$ A. T. borax. No niter was added. His results are as follows:

Assays of samples by J. B. Eckfeldt.

No.	Silver.		Gold.	Total value. ^a
	Oz. per ton.	Oz. per ton.	Per ton.	
9.	0.3	0.01		\$0.38
10.	.35	Trace.		.21
11.	Trace.	Trace.		-----
12.	.5	.02		.70
13.	.4	Trace.		.24
14.	Trace.	Trace.		-----
16.	.2	Trace.		.12

^aColumn added by W. Lindgren.

As statements were made that the shales examined contained considerable quantities of zinc (from 2 to 20 per cent), and certificates to this effect were shown me by local chemists, it was decided to test a few samples for zinc and also for copper. Samples 1, 5, and 8, respectively, from the quarry pits of Miller's, Gage's, and the Pioneer Company's mills were selected and examined by Dr. E. T. Allen, of the United States Geological Survey. These samples showed no trace of zinc or copper. The concretions in the shale just below the Fort Hays limestone (Septaria horizon) contain a brown carbonate of lime, which is frequently mistaken for zinc blende.^a

SUMMARY AND CONCLUSIONS.

Nineteen samples of Benton shale were collected in Ellis and Rush counties, Kans., chiefly along Smoky Hill River. These samples were taken with great care, each representing the average of a certain thickness of beds, in order to ascertain whether these shales contain gold and silver and whether, if so, they may be considered as of economic value. The majority of the samples were collected in pits and quarries from which material had been extracted by other parties for the purposes of assays or treatment in gold mills. These samples were first assayed for gold by myself, then by Dr. E. T. Allen. No gold was found in any of the samples. The silver could not be determined with great accuracy, for some pure silver was added in order to collect any gold that might be present, but there was certainly not more than a small fraction of an ounce in any one of the samples.

The same samples, except No. 3, of which sufficient material did not remain, were then assayed jointly by Dr. Allen and myself. Twelve samples showed the presence of small amounts of silver up to 6 cents per ton in value, while in 6 no silver or only doubtful traces were found. No. 5 showed 10 cents of gold per ton, and No. 13 a trace of gold. No gold was found in the remaining 16 samples.

Samples 1, 2, 4, 5, 6, 7, and 8 were assayed by Mr. W. F. Bowen, acting assayer of the mint bureau. In five of these small values of silver were found, ranging up to 27 cents per ton. In two of the samples no silver was found. One of the samples (No. 7) gave \$1 of gold per ton; this assay was repeated, and this time no gold was found. Traces of gold were found in three samples, and in three samples of the seven no gold was found.

Samples 9, 10, 11, 12, 13, 14, and 16 were then assayed by Mr. Jacob B. Eckfeldt, assayer of the mint in Philadelphia. In five of these silver was found, ranging up to 30 cents per ton, while two samples yielded only a trace. No. 12 gave 40 cents of gold per ton, and No. 9 gave 20 cents per ton, while traces of gold were found in the remaining five samples. In all, 77 assays were made of material taken from the 19 samples.

The results indicate that minute quantities of silver are often contained in these shales and that some samples show the presence of very small quantities of gold. The same samples do not always give the same results when repeated, which goes to confirm the statement on page 5, that the metals when present are somewhat unevenly distributed through the rock. None of the samples contain silver or gold in economically important quantities. While, of course, it is impossible to say what may be contained in those parts of the shale beds which have not been assayed, it is extremely improbable that this material will ever be of economic importance as a silver or gold ore.

INDEX.

Page.	Page		
Allen, E. T., assays by	14-15	Gmelin-Kraut, cited.....	16
samples examined by	18,19	Haworth, E., cited	18
Artz, H. H., shaft sunk by	5	divisions of Kansas Cretaceous by	7
Assays, irregularity of results of	5	views of	5
methods of	13-14	Hillebrand, W. F., limit of accuracy for	
results of	14-19	silver assays given by	14
samples for, method of collecting	10,18	Inoceramus horizon in western Kansas.	
samples for, method of preparation of	12-13	thickness of	10
samples collected for, table showing	10-12	Kansas Pioneer Gold Shale Company.	
summary of	18-19	mill built by	6
Bituminous shale in western Kansas,		reference to	5
thickness of	7	Lincoln marble in western Kansas, thick-	
Blue Hill shales, character and out-		ness of	7
crops of	8	Lovewell, J. T., cited	5
samples from	8	Miller, W. F., reference to	6
thickness of	7	Niobrara group of rocks in western Kan-	
Bowen, W. F., assays by	17,18,19	sas	7,8
Copper, samples tested for	18	Ostrea shales, character and outcrops of	8-9
Cretaceous rocks in the region, extent		samples from	9
and character of	7-9	thickness of	7
section of	7	Pleistocene rocks in the region, character	
Drainage of the region, features of	6-7	of	9
Eckfeldt, J. B., assays by	18,19	Roberts, G. E., assays under direction of	17-18
Fahrig, Ernst, assays by, results of	5	Rocks of the region, character and out-	
Fahrig Mining and Milling Company,		crops of	7-9
organization of	6	Samples for assay, method of collecting	10,18
Fencepost limestone in western Kansas,		method of preparation of	12-13
thickness of	7	table showing	10-12
Flagstone in western Kansas, thickness of	7	Smoky Hill chalk, thickness of	7
Fort Benton group of rocks in western		Smoky Hill River, course and character	
Kansas	7,8-9	of	6-7
Fort Hays limestone, character and out-		mills erected on	6
crops of	8	shaft sunk near	5
thickness of	7	Topography of the region, features of	6-7
Gage, A. G., mill built by	6	Trego County, shaft sunk in	5
Geology of the region, features of	7-9	Zinc, samples tested for	18



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UNITED STATES GEOLOGICAL SURVEY

CHARLES D. WALCOTT, DIRECTOR

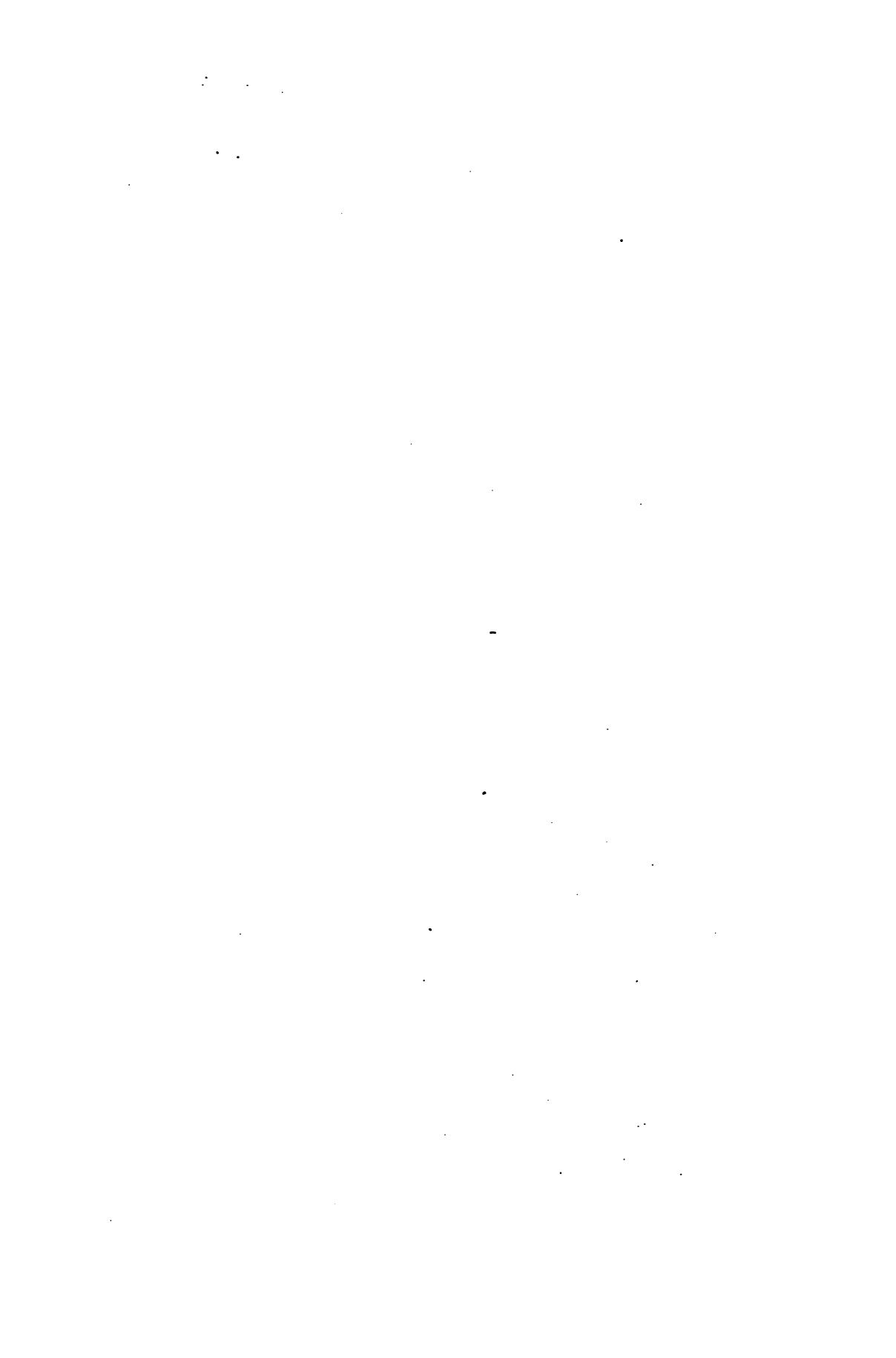
BIBLIOGRAPHY AND INDEX
OF
NORTH AMERICAN GEOLOGY, PALEONTOLOGY, PETROLOGY
AND MINERALOGY

FOR
THE YEAR 1901

BY
FRED BOUGHTON WEEKS



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CONTENTS.

	Page.
Letter of transmittal.....	5
Introduction.....	7
List of publications examined.....	9
Bibliography.....	13
Addenda to bibliographies for previous years.....	95
Classified key to the index.....	97
Index.....	103



LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., July 22, 1902.

SIR: I have the honor to transmit herewith the manuscript of a Bibliography and Index of North American Geology, Paleontology, Petrology, and Mineralogy for the Year 1901, and to request that it be published as a Bulletin of the Survey.

Yours respectfully,

F. B. WEEKS.

Hon. CHARLES D. WALCOTT,
Director United States Geological Survey.



BIBLIOGRAPHY AND INDEX OF NORTH AMERICAN GEOLOGY, PALEONTOLOGY, PETROLOGY, AND MINERALOGY FOR THE YEAR 1901.

By FRED BOUGHTON WEEKS.

INTRODUCTION.

The preparation and arrangement of the material of the Bibliography and Index for 1901 is similar to that adopted for the previous publications (Bullétins Nos. 130, 135, 146, 149, 156, 162, 172, 188, and 189). Several papers that should have been entered in the previous bulletins are here recorded, and the date of publication is given with each entry.

Bibliography.—The bibliography consists of full titles of separate papers, arranged alphabetically by authors' names, an abbreviated reference to the publication in which the paper is printed, and a brief description of the contents, each paper being numbered for index reference.

Index.—The subject headings, their subdivisions and arrangement, are shown in the classified key to the index, which immediately precedes the index. Reference is made in each entry by author's name and number of article in the Bibliography.

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Describes the physiography, the character and occurrence of the Carboniferous, Cretaceous and Pleistocene strata, and the occurrence of economic products.

101 —— Concerning the occurrence of gold and some other mineral products in Iowa.

Am. Geol., vol. 27, pp. 363-372, 1901.

Describes the origin and occurrence of various minerals and notes some of the popular fallacies that are held concerning them.

102 **Campbell** (Douglas H.). [Review of "Studies in fossil botany," by D. H. Scott.]

Am. Nat., vol. 35, pp. 73-77, 1901.

103 **Campbell** (John T.). Evidence of a local subsidence in the interior [Indiana].

Jour. Geol., vol. 9, pp. 437-438, 1901.

Difference in levelings made in 1883 and in 1901 show a subsidence in Parke County, Indiana.

104 **Campbell** (Marius R.). Hypothesis to account for the extra-glacial abandoned valleys of the Ohio Basin.

Abstracts: Geol. Soc. Am., Bull., vol. 12, p. 462 (4 p.), 1901.

Science, new ser., vol. 13, pp. 98-99, 1901.

Discusses their formation as due to formation and persistence of local ice dams.

105 —— Charleston Folio—West Virginia.

U. S. Geol. Surv., Geol. Atlas of U. S., Folio No. 72, 1901.

Describes the geographic and topographic features of the region, the stratigraphy, the character and occurrence of the Carboniferous and Pleistocene strata, the geologic structure, and the mineral resources of the quadrangle.

106 **Carter** (O. S. C.). Artesian wells as a water supply for Philadelphia.

Franklin Inst., Jour., Jan., 1893. (Not seen.)

107 —— Artesian wells.

Franklin Inst., Jour., Sept., 1893. (Not seen.)

108 —— Anthracite coal near Perkiomen Creek.

Franklin Inst., Jour., August, 1894. (Not seen.)

109 —— Drilling for oil and natural gas in the vicinity of Philadelphia.

Franklin Inst., Jour., Sept., 1894. (Not seen.)

110 **Carter** (O. S. C.). Ferruginized tree.
Franklin Inst., Jour., March, 1896. (Not seen.)

111 — **The Upper Schuylkill River.**
Franklin Inst., Jour., Nov., 1897. (Not seen.)

112 — **Denver's water supply.**
Phila. Sunday Times, Oct. 22, 1899. (Not seen.)

113 — **The Grand Canyon of the Colorado.**
Phila. Sunday Times, Dec. 24 and 31, 1899. (Not seen.)

114 — **Denver's water supply.**
Published in the Philadelphia Sunday Times, Oct. 22, 1899. (Not seen.)

115 — **Limestones in vicinity of Philadelphia, and hydraulic cement.**
Phila. Times, April 8, 1900. (Not seen.)

116 — **The source of Camden's [New Jersey] artesian water supply.**
Published in the Philadelphia Sunday Times, June 10, 1900. (Not seen.)

117 — **The petrified forest of Arizona.**
Published in the Philadelphia Sunday Times, July 8, 1900. (Not seen.)

118 — **The erosion of the shore line at Atlantic City—land made and lost.**
Published in the Philadelphia North American, Aug. 23, 1901. (Not seen.)

119 — **Atlantic City's [New Jersey] deep artesian well.**
Published in the Philadelphia Sunday Times, Aug. 24, 1901. (Not seen.)

120 **Case** (E. C.). Systematic Paleontology, Eocene Reptilia.
Md. Geol. Surv., pp. 95-98, pls. x-xi, 1901.

121 **Catlett** (Charles). Coal-outcrops.
Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 559-566 and 1005-1109, 1901.
Mines and Minerals, vol. 21, pp. 255-257, 3 figs., 1901.
Discusses the variations in character of the strata of outcrop and the conditions some distance under cover.

122 **Chalmers** (Robert). Notes on the Pleistocene marine shore lines and landslips of the north side of the St. Lawrence valley.
Can. Geol. Surv., new ser., vol. 11, Rept. J, Appendix I, pp. 63-70, 1901. Published in 1900.
Describes the shore lines and the occurrence of the landslips.

123 — **The sources and distribution of the gold bearing alluvions of Quebec.**
Ottawa Nat., vol. 15, pp. 33-36, 1 fig., 1901.
Describes the occurrence of gold and the source of the material.

124 **Chamberlin** (Thomas C.). [Geologic terminology.]
Jour. Geol., vol. 9, pp. 267-270, 1901.

125 —— [Review of "The Norwegian North polar expedition, 1893-1896. Scientific results, Vol. II."]
Jour. Geol., vol. 9, pp. 273-275, 1901.

126 —— [Review of "Meteorological observations of the second Wellman expedition," by Evelyn B. Baldwin.]
Jour. Geol., vol. 9, pp. 276-278, 1901.

127 —— On a possible function of disruptive approach in the formation of meteorites, comets, and nebulae.
Jour. Geol., vol. 9, pp. 369-392, pl. 1, 1901.
Discusses the possibility of mass disruption without collision and the probable effects.

128 —— [Review of "Rival theories of cosmogony," by O. Fisher.]
Jour. Geol., vol. 9, pp. 458-465, 1901.

129 —— Report on some studies relative to primal questions in geology.
Abstract: Sci. Am. Suppl., vol. 52, p. 21504, 1901.

130 —— On Lord Kelvin's address on the age of the earth as an abode fitted for life.
Smith. Inst., Ann. Rept., 1899, pp. 223-246, 1901.

131 **Chance** (H. M.). Gold ores of the Black Hills, South Dakota.
Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 278-285, 1901.
Describes the peculiar occurrence of gold in the nearly horizontal Cambrian sandstones and shales in the vicinity of Deadwood.

132 —— The iron-mines of Hartville, Wyoming.
Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 987-1003, 1 fig., 1901.
Describes the occurrence and character of the ore bodies and gives detailed descriptions of the mine workings.

133 **Charles** (H. W.). Dakota sandstone in Washington County, [Kansas].
Kans. Acad. Sci., Trans., vol. 17, p. 194, 1901.
Describes its general characteristics in this county.

134 **Charlton** (O. C.). Note on the Mort and Bluff meteorites.
Texas Acad. Sci., Trans., vol. 4, pp. 83-84, 1901.
Brief description of occurrence and character.

135 **Chatard** (T. M.) and **Whitehead** (Cabell). An examination of the ores of the Republic mine, Washington.
Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 419-423, 1901.
Describes the chemical studies made of these gold and silver ores.

136 **Chester** (Albert H.). Mineralogical notes and explorations.
N. J. Geol. Surv., Ann. Rept. for 1900, pp. 173-188, 1901.
Describes the occurrence and chemical composition of several minerals.

137 **Chibas** (Eduardo J.). Manganese mining in Cuba.
Mines and Minerals, vol. 21, pp. 295-296, 1901.
Abstract of report on the manganese mines near Santiago.

133 **Cilley** (Frank H.). Some fundamental propositions in the theory of elasticity. A study of primary or self-balancing stresses.
Am. Jour. Sci., 4th ser., vol. 11, pp. 269-290, 1901.
Discusses briefly the application of the theory to the study of the inner condition of the earth.

139 **Clapp** (Frederick G.). Geological history of the Charles River [Massachusetts].
Tech. Quart., vol. 14, pp. 171-201, figs. 1-13, 255-269, figs. 14-17, 1901.
Describes the various stages of the river's development and their causes, its relation to the geologic structure and the Tertiary and Glacial history of the region.

140 **Clark** (William Bullock) and **Martin** (George Curtis). The Eocene deposits of Maryland.
Md. Geol. Surv., Eocene, pp. 21-92, pls. 1-14, 1901.
Describes the general stratigraphic relations, distribution, characters, origin of the materials, and the stratigraphic and paleontologic characteristics of the Eocene strata. Discusses their correlation.

141 — Eocene Mollusca.
Md. Geol. Surv., Eocene, pp. 122-203, pls. xvii-lvii, 1901.

142 — Eocene Molluscoidea (Brachiopoda).
Md. Geol. Surv., Eocene, pp. 203-205, pl. 58, 1901.

143 — Eocene Echinodermata.
Md. Geol. Surv., Eocene, pp. 232-233, pl. 62, 1901.

144 **Clarke** (John M.). The Oriskany fauna of Beecraft Mountain, Columbia County, N. Y.
N. Y. State Mus., 53rd Ann. Rept., vol. 2, pp. 6-101, pls. 1-9, and geologic map, 1901.
See Clarke (J. M.), No. 971, in U. S. Geological Survey Bulletin, No. 188.

145 — Limestones of central and western New York interbedded with bituminous shales of the Marcellus stage, with notes on the nature and origin of their faunas.
N. Y. State Mus., Bull. No. 49, pp. 115-138, pl. 8, figs. 1-2, 1901.

146 — New Agelacrinites.
N. Y. State Mus., Bull. No. 49, pp. 182-198, pl. 10, figs. 1-7, 1901.
Reviews the literature regarding these forms and describes three new species.

147 — Value of *Amnigenia* as an indicator of fresh water deposits during the Devonic of New York, Ireland and the Rhineland.
N. Y. State Mus., Bull. No. 49, pp. 199-203, pl. 11, 1901.

148 **Clarke** (John M.). The Maryland Eocene book.
 Science, new ser., vol. 14, p. 27, 1901.
 Gives a brief review of this publication.

149 **Claypole** (E. W.). Notes on petroleum in California.
 Am. Geol., vol. 27, pp. 150-159, 1901.
 Describes the physiographic features of the oil areas, the general geology, and the source of the oil and gas.

150 —— The Sierra Madre near Pasadena [California].
 Abstracts: Jour. Geol., vol 9, pp. 69-70, 1901; Geol. Soc. Am., Bull., vol. 12, p. 494, 1901.
 Contains notes on the Tertiary strata and igneous rocks of the region.

151 **Clements** (J. Morgan), **Van Hise** (C. R.) and. The Vermilion iron-bearing district.
 See Van Hise (C. R.), 759.

152 **Coleman** (Arthur P.). Glacial and interglacial beds near Toronto [Canada].
 Jour. Geol., vol. 9, pp. 285-310, figs. 1-2, 1901.
 Describes the glacial history, the variations in climate and their effect on the then existing faunas and floras, and the glacial deposits of the region.

153 —— Marine and fresh-water beaches of Ontario.
 Geol. Soc. Am., Bull., vol. 12, pp. 129-146, figs. 1-2, 1901.
 Abstract: Science, new ser., vol. 13, p. 136, 1901.
 Describes the marine deposits, shell gravels, and beaches of the region.

154 —— The Vermilion River placers [Ontario].
 Ontario Bureau of Mines, Rept. for 1901, pp. 151-159, 1 fig., 1901.
 Describes the character and distribution of the placers.

155 —— Iron ranges of the Lower Huronian [Ontario].
 Ontario Bureau of Mines, Rept. for 1901, pp. 181-211, pls. 25-28, 1901.
 Describes the character and occurrence of the iron-ore bodies of various localities, and the petrographic characters of some of the associated rocks. Discusses the origin of some of the ores and includes notes on the Pleistocene geology.

156 —— Sea beaches of eastern Ontario.
 Ontario Bureau of Mines, Rept. for 1901, pp. 215-227, pls. 29-30, 1901.
 Contains notes on the Leda clay and Saxicava sand, and describes the character and occurrence of the beach sands and gravels and their faunas.

157 **Collie** (George Lucius). Wisconsin shore of Lake Superior.
 Geol. Soc. Am., Bull., vol. 12, pp. 197-216, figs. 1-2, 1901.
 Describes the general geology of the region, the shore formations and beach phenomena, and the characters of the wave erosion and its topography.

158 **Collie** (George Lucius). Physiography of Wisconsin.
Am. Bur. Geog., Bull., vol. 2, 20 pp., Sept., 1901. (Not seen.)

159 **Collier** (Arthur J.), **Brooks** (Alfred H.) and. Glacial phenomena
of the Seward Peninsula [Alaska].
See Brooks (A. H.) and Collier (A. J.), 81.

160 **Collins** (G. E.). Vein structure at the Reynolds mine, Georgia.
Eng. and Mg. Jour., vol. 72, pp. 68-70, figs. 1-11, 1901.
Discusses the vein phenomena in the auriferous crystalline rocks of
the region.

161 **Comstock** (Theodore B.). The geology and vein phenomena of
Arizona.
Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 1038-1101, fig. 1, 1901.
Gives a general description of the mineral regions. Discusses the
orographic disturbances and their effects on ore deposition, and describes
the stratigraphic succession in the state.

162 **Comstock** (W. J.), **Allen** (O. D.) and. Bastnasite and tysonite
from Colorado.
See Allen (O. D.) and Comstock (W. J.), 11.

163 **Cooper** (A. S.). The origin and occurrence of petroleum in Cali-
fornia.
Min. Ind. for 1901, pp. 505-509, fig. 1, 1901.
Describes the occurrence and character of the oil.

164 **Corless** (C. V.). The Coal Creek colliery of the Crows Nest Pass
Coal Co. [Canada].
Can. Mg. Rev., vol. 20, pp. 60-67, 16 figs., 1901.
Can. Mg. Inst., Jour., vol. 4, pp. 155-173, 11 figs., 1901.
Gives a general description of the geological occurrence of the coal.

165 **Courtier** (W. M.). [In discussion of paper by G. O. Smith and
Bailey Willis on "The Clealum iron ores, Washington."]
Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 1116-1117, 1901.
Gives additional analyses of these ores.

166 **Cowles** (Henry C.). The relation between baseleveling and plant
distribution.
Abstract: Science, new ser., vol. 13, pp. 372-373, 1901.

167 **Cragin** (F. W.). A study of some teleosts from the Russel sub-
stage of the Platte Cretaceous series.
Colo. Coll. Stud., vol. 9, pp. 25-37, 2 pls., 1901. (Not seen.)

168 **Crane** (W. R.). Kansas coal mining.
Eng. and Mg. Jour., vol. 72, pp. 748-752, 7 figs., 1901.
Describes the distribution and characters of the coal-bearing strata.

169 **Crosby** (W. O.). [Reviews of "Granites of southern Rhode Island and Connecticut, with observations on Atlantic Coast granites in general" by J. F. Kemp; "Contact metamorphism of a basic igneous rock" by U. S. Grant; "Suggestions regarding the classification of the igneous rocks" by W. H. Hobbs; "The nomenclature of feldspathic granolites" by H. W. Turner; and "Some contact phenomena of the Palisade diabase" by J. D. Irving.]
Am. Geol., vol. 27, pp. 51-54, 1901.

170 —— [Reviews of "A brief review of the titaniferous magnetites" by J. F. Kemp; "The origin of kaolin" by H. Ries; "Igneous complex of Magnet Cove, Arkansas" by H. S. Washington; "A granite-gneiss area in central Connecticut" by L. G. Westgate; and "The origin of nitrates in cavern earths" by W. H. Hess.]
Am. Geol., vol. 27, pp. 119-122, 1901.

171 —— [Review of "The calcareous concretions of Kettle Point, Lambton County, Ontario," by R. A. Daly; and "The granite rocks of the Pikes Peak quadrangle" by E. B. Mathews.]
Am. Geol., vol. 27, pp. 253-254, 1901.

172 —— [Review of "Some principles of rock analysis" by W. F. Hillebrand; and "Analyses of rocks, Laboratory of the U. S. Geological Survey" by F. W. Clarke.]
Am. Geol., vol. 27, pp. 315-316, 1901.

173 —— Are the amygdaloidal melaphyrs of the Boston Basin intrusive or contemporaneous?
Am. Geol., vol. 27, pp. 324-327, 1901.
Reviews a paper by Henry T. Burr.

174 —— The tripolite deposits of Fitzgerald Lake, near St. John, New Brunswick.
Tech. Quart., vol. 14, pp. 124-127, 1901.
Describes the character and origin of the deposit.

175 —— Geological history of the hematite iron ores of the Antwerp and Fowler belt in New York.
Tech. Quart., vol. 14, pp. 162-170, figs. 1-4, 1901.
Describes the character, occurrence, and origin of the hematite ores of the region.

176 **Cross** (Whitman), assisted by Arthur Coe Spencer. General geology, La Plata Folio—Colorado.
U. S. Geol. Surv., Geol. Atlas of U. S., Folio No. 60, 1899.
Describes the geographic and physiographic features, the character and occurrence of the Juratrias, Cretaceous, Eocene, and Pleistocene strata and igneous rocks, and the geological structure. Includes a statement of the general geologic problems of the region.

177 **Cross** (Whitman). Outline of geology. (Silverton quadrangle, Colorado.)

U. S. Geol. Surv., Bull. No. 182, pp. 29-39, 1901.

Describes the general characteristics of the sedimentary and igneous rocks and the structure of the region.

178 **Cummings** (Edgar R.). The use of Bedford as a formation name.

Jour. Geol., vol. 9, pp. 232-233, 1901.

Proposes the name Salem limestone for the Bedford limestone, the latter having been preoccupied.

179 — Orthothetes minutus, n. sp. from the Salem limestone of Harrodsburg, Indiana.

Am. Geol., vol. 27, pp. 147-149, pl. 15, 1901.

180 — A section of the upper Ordovician at Vevay, Indiana.

Am. Geol., vol. 28, pp. 361-380, pls. 34-35, 1901.

Gives a detailed section, names the fossils found in each bed, and compares this section with that at Cincinnati. Describes four new species.

181 — Notes on the Ordovician rocks of southern Indiana.

Ind. Acad. Sci., Proc. for 1900, pp. 200-215, 1901.

Gives section at various localities with notes on the faunas.

182 — Some developmental stages of Orthothetes minutus n. sp.

Ind. Acad. Sci., Proc. for 1900, pp. 216-218, 1901.

183 **Currie** (P. W.). On the ancient drainage at Niagara Falls.

Can. Inst., Trans., vol. 7, pp. 7-14, 6 pls., 1901.

Describes the course of the preglacial river and discusses its mode of formation.

184 **Cushing** (H. P.). Origin and age of an Adirondack augite andesite.

Abstracts: Geol. Soc. Am., Bull., vol. 12, p. 464 (½ p.), 1901.

Science, new ser., vol. 13, p. 100, 1901.

Brief description of character and occurrence.

185 — Geology of Rand Hill and vicinity, Clinton County [New York].

N. Y. State Mus., 53d Ann. Rept., vol. 1, pp. r45-r82, and geologic map, 1901.

Describes the general geologic history of the region, and the pre-Cambrian and Paleozoic rocks.

D.

186 **Dall** (William H.). The structure of Diamond Head, Oahu.

Am. Geol., vol. 27, pp. 386-387, 1901.

Refers to the controversy as to the origin of Diamond Head, and states the author's conclusions.

187 — The morphology of the hinge teeth of bivalves.

Am. Nat., vol. 35, pp. 175-182, 1901.

188 **Dall** (William H.). A gigantic fossil *Lucina*.
 Nautilus, vol. 15, pp. 40-42, 1901.
 Describes *Lucina megameris* from Jamaica

189 — and **Bartsch** (Paul). A new Californian *Bittium*.
 Nautilus, vol. 15, pp. 58-59, 1901.

190 **Daly** (Reginald A.). The physiography of Acadia.
 Harv. Coll., Mus. Comp. Zool., Bull., vol. 38, pp. 73-103, pls. 1-11, 1901.
 Abstract: *Am. Geol.*, vol. 27, pp. 317-318, 1901.
 Describes the characteristics of the several plateau and lowland areas and discusses their origin.

191 — Notes on oceanography.
 Science, new ser., vol. 13, pp. 951-954, 1901.
 Discusses phenomena of marine currents and river deflection.

192 **Dana** (Edward S.). On the composition of the labradorite rocks of Waterville, New Hampshire.
 Yale Bicentennial publications, Cont. to Mineral. and Petrog., pp. 387-390, 1901. (From *Am. Jour. Sci.*, 3rd ser., vol. 3, pp. 48-50, 1872.)

193 — — **Brush** (George J.) and. On a new and remarkable mineral deposit at Branchville, in Fairfield County, Connecticut; with a description of several new species occurring there. First paper.
 See *Brush (G. J.) and Dana (E. S.)*, 88.

194 — — Second Branchville paper.
 See *Brush (G. J.) and Dana (E. S.)*, 89.

195 — — Third Branchville paper.
 See *Brush (G. J.) and Dana (E. S.)*, 90.

196 — — Fourth Branchville paper—spodumene and the results of its alteration.
 See *Brush (G. J.) and Dana (E. S.)*, 91.

197 — — Fifth Branchville paper; with analyses of several manganese phosphates, by Horace T. Wells.
 See *Brush (G. J.) and Dana (E. S.)*, 92.

198 **Darton** (Nelson Horatio). Preliminary description of the geology and water resources of the southern half of the Black Hills and adjoining regions in South Dakota and Wyoming.
 U. S. Geol. Surv., 21st Ann. Rept., Pt. IV, pp. 497-599, pls. lviii-cxii, figs. 272-299, 1901.
 Abstract: *Jour. Geol.*, vol. 9, pp. 732-734, 1901.
 Describes the character and occurrence of the Cambrian, Carboniferous, Juratrias, Crétaceous, Tertiary, and Pleistocene strata, and the water and mineral resources and soils of the region.

199 **Darton** (Nelson Horatio). Comparison of stratigraphy of the Black Hills with that of the Front range of the Rocky Mountains.

Abstracts: Geol. Soc. Am., Bull., vol. 12, p. 478 (4 p.), 1901; Science, new ser., vol. 13, p. 188, 1901.

200 — and **Keith** (Arthur). Washington Folio, Dist. of Columbia, Maryland, Virginia.

U. S. Geol. Surv., Geol. Atlas of U. S., Folio No. 70, 1901.

Describes geographic and topographic features, the character and occurrence of Archean rocks and of the Cretaceous, Eocene, Neocene, and Pleistocene strata, the general structure of the Piedmont and Coastal plain regions, and mineral resources of the area.

201 **Davis** (Charles A.). A second contribution to the natural history of marl.

Jour. Geol., vol. 9, pp. 491-506, 1901.

Abstract: Am. Geol., vol. 27, p. 186, 1901.

202 **Davis** (William M.). An excursion to the Grand Canyon of the Colorado.

Harv. Coll., Mus. Comp. Zool., Bull., vol. 38, pp. 108-201, pls. 1-2, figs. 1-18, 1901.

Abstracts: Geol. Soc. Am., Bull., vol. 12, p. 483 (4 p.), 1901; Geol. Mag., new ser., dec. 4, vol. 8, p. 324, 1901; Science, new ser., vol. 13, p. 138, 1901.

Describes the denudation and displacements of the region and discusses the origin of the drainage system.

203 — Peneplains of central France and Brittany.

Abstract: Geol. Soc. Am., Bull., vol. 12, pp. 480-487, pls. 44-45, 1901.

Discusses the theory of peneplains.

204 — Note on river terraces of New England.

Abstract: Geol. Soc. Am., Bull., vol. 12, pp. 483-485, 1 fig., 1901.

Discusses the formation of these terraces.

205 — Current notes on physiography.

Science, new ser., vol. 13, pp. 152-153, 1901.

Contains notes on the Dalles of the Wisconsin and the islands of southern California.

206 — Current notes on physiography.

Science, new ser., vol. 13, pp. 275-276, 1901.

Contains abstract of paper by H. W. Turner on the origin of Yosemite Valley.

207 — Current notes on physiography.

Science, new ser., vol. 13, pp. 351-352, 1901.

Contains abstracts of papers by I. C. Russell on the geology of the Cascade Mountains and by W. T. Lee on the glacier of Mt. Arapahoe,

208 **Davis** (William M.). Current notes on physiography.
Science, new ser., vol. 13, pp. 395-397, 1901.
Contains abstract of paper by Abbe on the physiography of Allegany County, Maryland.

209 —— Current notes on physiography.
Science, new ser., vol. 13, pp. 471-472, 1901.
Contains abstract of paper by Ganong on the physiography of New Brunswick.

210 —— Current notes on physiography.
Science, new ser., vol. 13, pp. 551-552, 1901.
Contains brief abstract of paper by Lindgren, describing the Snake River canyon.

211 —— Current notes on physiography.
Science, new ser., vol. 13, pp. 628-629, 1901.
Contains brief abstract of monograph on the Illinois glacial lobe and describes reversion in river development in Pennsylvania.

212 —— Current notes on physiography.
Science, new ser., vol. 13, pp. 751-753, 1901.
Contains abstracts of second folio of the Topographic atlas of the United States and of paper by Lee on the debris-covered mesas of Boulder, Colorado.

213 —— Current notes on physiography.
Science, new ser., vol. 13, pp. 791-793, 1 fig., 1901.
Contains abstracts of the third folio of the Topographic atlas of the United States by R. T. Hill, and of a paper by Crosby on the Nashua Valley, Massachusetts.

214 —— Current notes on physiography.
Science, new ser., vol. 13, pp. 871-872, 1901.
Gives an abstract of paper by Jones on the Tallulah gorge in Georgia.

215 —— Current notes on physiography.
Science, new ser., vol. 13, pp. 950-951, 1901.
Reviews recently published folios of the Geologic atlas of the United States.

216 —— Current notes on physiography.
Science, new ser., vol. 14, pp. 152-153, 1901.
Gives an abstract of a paper by Matthes on the Glacial sculpture of the Big Horn Mountains.

217 —— Current notes on physiography.
Science, new ser., vol. 14, pp. 299-330, 1901.
Gives an abstract of paper by Shattuck on the Pleistocene problem of the North Atlantic Coastal plain.

218 —— Current notes on physiography.
Science, new ser., vol. 14, pp. 457-459, 1901.
Reviews paper by Spurr on the structure of the Basin ranges.

219 **Davis** (William M.). Current notes on physiography.

Science, new ser., vol. 14, pp. 537-538, 1901.

Contains remarks on glacial lakes in Minnesota, esker lakes in Indiana and the Ontario coast.

220 — Current notes on physiography.

Science, new ser., vol. 14, pp. 698-699, 1901.

Refers to dikes as topographic features, the character of the plain of St. Lawrence Valley and the question of peneplains.

221 — Current notes on physiography.

Science, new ser., vol. 14, pp. 778-779, 1901.

Reviews papers by Johnson on the High Plains and by Low on the south shore of Hudson Strait.

222 — Current notes on physiography.

Science, new ser., vol. 14, pp. 856-859, 1901.

Reviews Hobbs's paper on the River system of Connecticut and Dowling and Tyrrell on Lake Winnipeg.

223 **Dawson** (George M.). Summary report on the operations of the Geological Survey for the year 1898.

Can. Geol. Surv., new ser., vol. 11, Rept. A, 208, pp., 1901, published in 1899.

224 — Geological record of the Rocky Mountain region in Canada.

Geol. Soc. Am., Bull., vol. 12, pp. 57-92, 1901.

Gives an account of the physiographic features and a table of geologic formations of the region. Describes the character and occurrence of the rocks of the subdivisions of the Archean, Paleozoic, Mesozoic, and Cenozoic eras.

225 — Physical history of the Rocky Mountain region in Canada.

Science, new ser., vol. 13, pp. 401-407, 1901.

Contains portion of address delivered before the Geological Society of America.

226 **Day** (David T.). Notes on the occurrence of platinum in North America.

Am. Inst. Mg. Engrs., Trans. vol. 30, pp. 702-708, 1901.

Describes the geographic distribution of platinum and its occurrence on the Pacific Coast.

227 **Dean** (Bashford). On two new Arthrodires from the Cleveland shale of Ohio.

N. Y. Acad. Sci., Mem., vol. 2, pp. 86-100, pls. 2-7, figs. 1-2, 1901.

228 — On the characters of *Mylostonia* Newberry.

N. Y. Acad. Sci., Mem., vol. 2, pp. 101-109, pls. 7-8, figs. 3-10, 1901.

229 — Further notes on the relationships of the Arthrognathi.

N. Y. Acad. Sci., Mem., vol. 2, pp. 110-123, figs. 12-18, 1901.

Discusses the position of the Arthrognathi and the systematic arrangement and nomenclature of the structures.

230 **Diller** (Joseph Silas). *Geomorphogeny of the Klamath Mountains [California—Oregon].*

Abstracts: *Geol. Soc. Am., Bull.*, vol. 12, p. 461 (1 p.), 1901.
Science, new ser., vol. 13, p. 97, 1901.

231 —— *Coos Bay Folio—Oregon.*

U. S. Geol. Surv., Geol. Atlas of U. S., Folio No. 73, 1901.

Describes the topographic features, the character and the occurrence of the Cretaceous, Eocene, Neocene, and Pleistocene deposits and igneous rocks, and the occurrence of coal and gold.

232 **Dodge** (Richard E.). *Landslides of Echo and Vermillion cliffs.*

Abstract: *Geol. Soc. Am., Bull.*, vol. 12, p. 485 (7 l.), 1901.

233 **Donald** (J. T.). *The composition of some Canadian limestones.*

Can. Mg. Rev., vol. 20, pp. 67–68, 1901.

Can. Mg. Inst., Jour., vol. 4, pp. 152–154, 1901.

Gives chemical analyses and notes on the economic uses of these limestones.

234 **Douglass** (Earl). *New species of *Merycochœrus* in Montana.*

Part II.

Am. Jour. Sci., 4th ser., vol. 11, pp. 73–89, figs. 1–5, 1901.

Describes material from Tertiary beds.

234a —— *Fossil mammalia of the White River beds of Montana.*

Am. Phil. Soc., Trans. new ser., vol. 20, pp. [only separate seen], pl. ix and map, 1901.

Describes the characters of the strata and of the fossil mammals collected.

235 **Douglas** (James). *Record of borings in the Sulphur Spring Valley, Arizona; and of agricultural experiments in the same locality.*

Am. Phil. Soc., Proc., vol. 40, pp. 161–163, 1 fig., 1901.

Gives record of well boring in the valley to the depth of 765 feet.

236 **Dowling** (D. B.). *Report on the geology of the west shore and islands of Lake Winnipeg.*

Can. Geol. Surv., new ser., vol. 11, *Rept. F.*, 100 pp., 2 pls., 10 figs. 1901, published in 1900.

Describes the physiography, the character, occurrence, and faunas of the Ordovician strata and the glacial phenomena of the region.

237 —— *The physical geography of the Red River Valley [Canada].*

Ottawa Nat., vol. 15, pp. 115–120, pls. 8–9, 1901.

Describes the physiographic history of the region.

238 —— See **Tyrrell** (J. B.), 747.

239 **Dresser** (John A.). *A hornblende lamprophyre dike at Richmond, P. Q.*

Can. Rec. Sci., vol. 8, pp. 315–320, 1901.

Describes the occurrence of the dike and the characters of the dike rock.

240 **Dresser** (John A.). A preliminary note on an amygdaloidal trap rock in the eastern townships of the Province of Quebec.

Ottawa Nat., vol. 14, pp. 180-182, 1901.

Describes the megascopic and microscopic characters of the rock.

241 —— On the petrography of Mt. Orford.

Am. Geol., vol. 27, pp. 14-21, 1901.

Describes occurrence and character of diabase, gabbro-diorite, serpentine, and ophicalcite, and gives a summary of the geologic history of the region.

242 —— On the petrography of Shefford Mountain [Quebec].

Am. Geol., vol. 28, pp. 204-213, pl. 21, 1901.

Describes petrographic characters of essexite, nordmarkite, and pulaskite, and discusses their relations.

243 **Dryer** (Charles R.). Certain peculiar eskers and esker lakes of northeastern Indiana.

Jour. Geol., vol. 9, pp. 123-129, figs. 1-2, 1901.

Describes glacial phenomena of the region.

244 —— Lessons in physical geography.

American Book Co., 1901.

Review, Jour. Geol., vol. 9, pp. 638-639, 1901.

245 **Dumble** (E. T.). Cretaceous of Obispo Canyon, Sonora, Mexico.

Texas Acad. Sci., Trans., vol. 4, p. 81, 1901.

Gives brief description of the character of the beds.

246 —— Occurrence of oyster shells in volcanic deposits in Sonora, Mexico.

Texas Acad. Sci., Trans., vol. 4, p. 82, 1901.

Gives brief description of occurrence.

247 —— The iron ores of east Texas.

Eng. & Mg. Jour., vol. 72, p. 104 (½ p.), 1901.

Contains brief notes on the character of the ores.

248 —— Geology of the Beaumont oil fields (Texas).

Houston, Texas, June, 1901. (Not seen.)

249 **Dwight** (W. B.). Fort Cassin beds in the Calciferous limestone of Dutchess County, New York.

Abstract: Geol. Soc. Am., Bull., vol. 12, pp. 490-491, 1901.

Contains notes on the faunas of these beds.

E.

250 **Eakle** (Arthur S.). Mineralogical notes, with chemical analyses by W. T. Schaller.

Univ. of Cal., Dept. of Geol., Bull., vol. 2, pp. 315-326, pl. 9, 1901.

Describes pectolite, zircon crystals, esmeraldaite, coquimbite, and altaite crystals.

251 **Eastman** (Charles R.). Systematic paleontology, Eocene Pisces. Md. Geol. Surv., Eocene, pp. 98-115, pls. 12-15, 1901.

252 — On *Campodus*, *Edestus*, *Helicoprion*, *Acanthodes*, and other Permo-Carbonifeous sharks.
Abstracts: Science, new ser., vol. 14, p. 795, 1901.
Sci. Am. Suppl., vol. 52, p. 21505, 1901.

253 **Eckel** (Edwin C.). The formation as the basis for geologic mapping.
Jour. Geol., vol. 9, pp. 708-717, 1901.
Discusses the problems involved and the application of the proposed system.

254 — The emery deposits of Westchester County, New York.
Min. Ind. for 1900, pp. 15-17, 1901.
Describes briefly the character and occurrence of the deposits.

254a — A recently discovered extension of the Tennessee white phosphate fields.
U. S. Geol. Surv., Min. Res. for 1900, pp. 812-813, 1901.
Briefly describes occurrence in Decatur County.

255 **Eldridge** (George H.). The asphalt and bituminous rock deposits of the United States.
U. S. Geol. Surv. 22nd Ann. Rept., Pt. 1, pp. 209-452, pls. xxv-lviii, fig. 1-52, 1901.
Describes the character and geologic occurrence of these materials in the United States.

256 **Ells** (R. W.). Report on the geology of the Three Rivers map sheet or northwestern sheet of the eastern townships map, Quebec.
Can. Geol. Surv., new ser., vol. 11. Rept. J., 70 pp., 4 pls., 1901.
Published in 1900.
Describes the physiography, the character, and occurrence of the Ordovician, Silurian, and Pleistocene deposits and economic resources of the region.

257 — The physical features and geology of the Paleozoic basin between the Lower Ottawa and St. Lawrence rivers.
Can. Roy. Soc., Proc. & Trans., 2nd ser., vol. 6, sect. 4, pp. 99-120, 1900.
Describes the character and occurrence of the Paleozoic rocks and the structure of the region.

258 — The Carboniferous basin of New Brunswick.
Can. Roy. Soc., Proc. and Trans., 2nd ser., vol. 7, sect. 4, pp. 45-56.
(Not seen.)
Abstract: Science, new ser., vol. 13, p. 1017, 1901.

259 **Ells** (R. W.). The Devonian of the Acadian provinces.

Can. Rec. Sci., vol 8, pp. 335-343, 1901.

Reviews previous geologic work on the Devonian strata of the region and discusses the problems involved.

260 — Ancient channels of the Ottawa River [Canada].

Ottawa Nat., vol. 15, pp. 17-30, 1 map, 1901.

Describes glacial phenomena of the region.

261 **Emmons** (Samuel Franklin). The secondary enrichment of ore deposits.

Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 177-217, 1901.

Discusses the process of the secondary enrichment of sulphide ore bodies by transference and reconcentration of the alteration products of the original vein materials by descending surface waters and the chemical reactions which take place. Describes the author's observations in various mining districts and discusses their bearing on these problems.

262 — Notes on two desert mines in southern Nevada and Utah.

Abstract: Science, new ser., vol. 13, pp. 426-427, 1901.

Contains abstract of paper read before the Geological Society of Washington.

F.

263 **Fairbanks** (Harold W.). Notes on the geology of the Three Sisters, Oregon.

Abstracts: Jour. Geol., vol. 9, p. 73 (½ p.), 1901.

Geol. Soc. Am., Bull., vol. 12, pp. 498-499 (½ p.), 1901.

Brief notes on occurrence of volcanic rocks.

264 — Pyramid Lake, Nevada.

Pop. Sci. Mo., vol. 58, pp. 405-514, figs. 1-8, 1901.

Describes the geological history of the lake and adjacent region and the characteristics of the volcanic materials.

265 **Fairchild** (Herman LeRoy). Beach structure in Medina sandstone.

Am. Geol., vol. 28, pp. 9-14, pls. ii-iv, 1901.

Review, Jour. Geol., vol. 9, pp. 549-550, 1901.

Discusses the evidences indicating the origin of the ripple marks in the Medina sandstone of New York.

266 **Farnsworth** (P. J.). When was the Mississippi River Valley formed?

Am. Geol., vol. 28, pp. 393-396, 1901.

Discusses the geologic history of the region.

267 **Farrington** (Oliver Cummings). On the nature of the metallic veins of the Farmington meteorite.

Am. Jour. Sci., 4th ser., vol. 11, pp. 60-62, fig. 1, 1901.

268 — The structure of meteorites.

Jour. Geol., vol. 9, pp. 51-66, figs. 1-6, pp. 174-190, figs. 7-11, 1901.

Describes the various structural features of meteorites and discusses their origin.

269 **Farrington** (Oliver Cummings). The constituents of meteorites. *Jour. Geol.*, vol. 9, pp. 393-408, and 522-532, 1901. Describes the character and occurrence of the mineral constituents of meteorites.

270 — The pre-terrestrial history of meteorites. *Jour. Geol.*, vol. 9, pp. 623-632, 1901. Discusses the evidences indicating the probable structure of meteorites before reaching the earth.

271 — Observations on Indiana caves. *Field Col. Mus., Geol. ser.*, vol. 1, pp. 247-266, pls. 32-33, figs. 1-8, 1901.

272 **Finlay** (George I.). The granite of Barre, Vermont. Abstract: *Science, new ser.*, vol. 13, p. 509 (½ p.), 1901. *N. Y. Acad. Sci., Annals*, vol. 14, pp. 101-102, 1901. Briefly describes megascopic and microscopic characters.

273 **Fisher** (C. A.). Comparative value of bluff and valley wash deposits as brick material. *Nebr. Board of Agric., Ann. Rept.*, 1900, pp. 181-184. (Not seen.)

274 — **Gould** (C. N.) and. The Dakota and Carboniferous clays of Nebraska. See Gould (C. N.) and Fisher (C. A.), 305.

275 **Fisher** (O.). On rival theories of cosmogony. *Am. Jour. Sci.*, 4th ser., vol. 11, pp. 414-422, 1901. Review by T. C. Chamberlin, *Jour. Geol.*, vol. 9, pp. 458-465, 1901. Discusses the meteoric and nebular theories as to the origin of the earth.

276 — Mathematical notes to rival theories of Cosmogony. *Am. Jour. Sci.*, 4th ser., vol. 12, pp. 140-142, 1901. Contains mathematical notes supplementary to the author's previous paper.

277 **Flink** (Gust.). On the minerals from Narsarsuk on the firth of Tunugdliarfik in southern Greenland. *Meddelelser om Gronland*, vol. 24, pp. 11-213, pls. I-IX, 1901. (Not seen.)

278 **Foerste** (August F.). Silurian and Devonian limestones of Tennessee and Kentucky. *Geol. Soc. Am., Bull.*, vol. 12, pp. 395-444, pls. 35-41, 1901. Discusses the occurrence and lithologic character of the Ordovician, Silurian and Devonian series in the southern portion of the Cincinnati anticline and discusses the evidences of unconformity. Gives lists of fossils from several formations at various points in the region.

279 — The Niagara group along the western side of the Cincinnati anticline. Abstract: *Science, new ser.*, vol. 13, pp. 134-135, 1901.

280 **Foord** (Arthur H.). [Reviews of "Report on the geology and natural resources of the country traversed by the Yellow Head pass route from Edmonton to Tete Jaune Cache, comprising portions of Alberta and British Columbia," by James McErvoy; "On some additional or imperfectly understood fossils from the Cretaceous rocks of the Queen Charlotte Islands, with a revised list of the species from these rocks," by J. F. Whiteaves; and "General Index to the Reports of Progress, 1863 to 1884," by D. B. Dowling.] *Geol. Mag.*, new ser., dec. iv, vol. 8, pp. 136-139, 1901.

281 **Foote** (H. W.), **Penfield** (S. L.) and. On bixbyite, a new mineral.
See *Penfield* (S. L.) and *Foote* (H. W.), 598.

282 — — — On clinohedrite, a new mineral from Franklin, N. J.
See *Penfield* (S. L.) and *Foote* (H. W.), 599.

283 — — — **Pratt** (J. H.) and. On wellsite, a new mineral.
See *Pratt* (J. H.) and *Foote* (H. W.), 624.

284 **Ford** (W. E.), **Penfield** (S. L.) and. On calavarite.
See *Penfield* (S. L.) and *Ford* (W. E.), 600.

285 **Fraas** (E.). [Origin of the Oligocene beds of the Bad Lands, South Dakota.]
Science, new ser., vol. 14, pp. 211-212, 1901.
Contains quotation from letter to Professor Osborn.

286 **Frazer** (Persifor). Memoir of Franklin Platt.
Geol. Soc. Am., Bull., vol. 12, pp. 454-455, 1901.
Gives a brief sketch of his life and a list of his publications.

287 — — — The Eighth Session of the International Congress of Geologists.
Am. Geol., vol. 27, pp. 335-342, 1901.

288 **Fuller** (Myron L.). Probable representatives of the pre-Wisconsin till in southeastern Massachusetts.
Jour. Geol., vol. 9, pp. 311-329, figs. 1-6, 1901.
Abstract: *Science*, new ser., vol. 13, p. 664 (§ p.), 1901.
Describes the occurrence and character of the till at various localities and the occurrence of possible interglacial rock disintegration.

289 **Furman** (H. van F.). Gold mining in Alaska.
Mines and Minerals, vol. 21, pp. 433-436, 4 figs., 1901.
Describes character and occurrence of gold ores in southeastern Alaska.

G.

290 **Gannett** (Henry). Profiles of rivers.
U. S. Geol. Surv., Water Supply and Irrigation Papers, No. 44, 100 pp., 11 pls., 1901. Review, *Am. Geol.*, vol. 28, p. 56, 1901.

291 **Geikie** (Archibald). The founders of geology.

Johns Hopkins Univ., George Huntington Williams Memorial lectures, vol. 1, 297 pp., 1901.

Abstract: Am. Jour. Sci., 4th ser., vol. 11, p. 326 (§ p.), 1901.

292 **Gidley** (J. W.). Tooth characters and revision of the North American species of the genus *Equus*.

Am. Mus. Nat. Hist., Bull., vol. 14, pp. 91-142, pls. 18-21, figs. 1-27, 1901.

293 **Gilbert** (Grove Karl). Physical history of Niagara River [New York].

U. S. Geol. Surv., Map of Niagara River and vicinity, 1901.

Abstract: Am. Geol., vol. 27, pp. 375-377, 1901.

294 **Gilpin** (Edwin, jr.). The minerals of Nova Scotia.

Halifax, N. S., 78 pp., 1901. (Not seen.)

295 **Girty** (George H.). The Waverly group in northeastern Ohio.

Abstract: Science, new ser., vol. 13, p. 664 (§ p.), 1901.

Gives brief notes on the correlation and succession of the subdivisions.

296 **Gordon** (C. H.). On the origin and classification of gneisses.

Neb. Acad. Sci., Proc. VII, pp. 90-96, 1901.

297 **Gould** (Charles Newton). Notes on the fossils from the Kansas-Oklahoma Red Beds.

Jour. Geol., vol. 9, pp. 337-340, 1901.

Gives a description of the character of the Red beds and of the evidences on which they have been assigned to the Permian. Refers to fossils recently found in the beds.

298 — Notes on the geology of parts of the Seminole, Creek, Cherokee, and Osage Nations.

Am. Jour. Sci., 4th ser., vol. 11, pp. 185-190, 1901.

This paper is a contribution to the Red Beds problem of the region and indicates that the strata are of Permian and Carboniferous age.

299 — Tertiary Springs of western Kansas and Oklahoma.

Am. Jour. Sci., 4th ser., vol. 11, pp. 263-268, 1901.

Describes the occurrence of those springs at the contact between the Tertiary and the underlying Cretaceous or Red Bed strata.

300 — Notes on the Kansas-Oklahoma-Texas Gypsum Hills.

Am. Geol., vol. 27, pp. 188-190, 1901.

Describes the geologic features of the region and discusses the age of the beds.

301 — The Dakota Cretaceous of Kansas and Nebraska.

Kans. Acad. Sci., Trans., vol. 17, pp. 122-178, pls. 4-12, 1901.

Gives a historical sketch of work on the Dakota group, describes its geographic distribution, character, occurrence, and relations, its economic products, and the general characteristics of its faunas and flora. Includes a bibliography.

302 **Gould** (Charles Newton). On the southern extension of the Marion and Wellington formations.

Kans. Acad. Sci., Trans., vol. 17, pp. 179-181, 1901.
Describes their character and occurrence in Oklahoma.

303 — The Oklahoma salt plains.

Kans. Acad. Sci., Trans., vol. 17, pp. 181-184, 1901.
Describes the geologic formations of the region and the occurrence and character of the salt plains.

304 — Oklahoma limestones.

Stone, vol. 23, pp. 351-354, 1901.
Contains notes on the occurrence and character of the limestones.

305 — and **Fisher** (C. A.). The Dakota and Carboniferous clays of Nebraska.

Nebr. Board of Agric., Ann. Rept. 1900, pp. 185-194. (Not seen.)

306 **Grabau** (Amadeus W.). Guide to the geology and paleontology of Niagara Falls and vicinity.

Buffalo Soc. Nat. Sci. Bull., vol. 7, pp. 1-284, 18 pls., 190 figs., and geologic map; N. Y. State Mus., Bull. No. 45, pp. 1-284, 18 pls., 190 figs. and geologic map, 1901; Review, Am. Geol., vol. 28, pp. 56-57, 1901.

Describes the physiography of the region, the character, occurrence, and distribution of the Silurian and Devonian strata, and the fossils of the Silurian rocks. Includes a bibliography.

307 — A preliminary geologic section in Alpena and Presque Isle Counties, Michigan.

Am. Geol., vol. 28, pp. 177-189, pl. 20, 1901.
Gives a section of a well 1,250 ft. in depth and describes the character and occurrence of the Devonian strata of the section exposed.

308 — Recent contributions to the problem of Niagara.

Abstract: Science, new ser., vol. 14, p. 773, 1901; N. Y. Acad. Sci., Annals, vol. 14, p. 139, 1901; Am. Geol., vol. 28, pp. 329-330, 1901.
Contains abstract of paper read before the New York Academy of Sciences.

309 **Granger** (Walter), **Osborn** (Henry F.) and. Fore and hind limbs of Sauropoda from the Bone Cabin quarry [Wyoming].

See Osborn (H. F.) and Granger (W.), 585.

310 **Grant** (C. C.). Opening address. Geological Section [Hamilton Scientific Association].

Hamilton Sci. Assoc., Jour. & Proc. No. 17, pp. 62-77, 2 figs., 1901.
Contains notes on fossils collected near Hamilton, Ontario.

311 — Niagara Falls as an index of time.

Hamilton Sci. Assoc., Jour. & Proc. No. 17, pp. 78-83, 1 fig., 1901.

312 — Geological notes, etc.

Hamilton Sci. Assoc., Jour. & Proc. No. 17, pp. 84-96, 1 fig., 1901.
Discusses certain post-glacial problems.

313 **Grant** (Ulysses Sherman). Preliminary report on the copper bearing rocks of Douglas County, Wisconsin.
 Wis. Geol. & Nat. Hist. Surv. Bull. No. 6 (2d edition), 83 pp., pls. 1-13, fig. 1, 1901.
 Abstract: Am. Geol., vol. 28, pp. 323-324, 1901.
 Contains the material of the first edition and the results of the field work of 1900 in the same region.

314 — Junction of the Lake Superior sandstone and Keweenawan traps in Wisconsin.
 Abstract: Geol. Soc. Am., Bull., vol. 13, pp. 6-9, 1901.
 Describes the structural relations in Douglas County.

315 **Gratacap** (L. P.). Paleontological speculations.
 Am. Geol., vol. 27, pp. 75-100, 1901.
 Discusses the life history and development of various fossil forms.

316 — Paleontological speculations. II.
 Am. Geol., vol. 28, pp. 214-234, 1901.
 Discusses biological crises.

317 — The Ward-Coonley collection of meteorites.
 Sci. Am. Suppl., vol. 52, pp. 21382-21383, 1901.
 Contains notes on the characters of meteorites.

318 **Grave** (Caswell). The oyster reefs of North Carolina; a geological and economic study.
 Johns Hopkins Univ., Circ. No. 151, pp. 50-53, 2 figs., 1901.

319 **Greene** (George K.). Contribution to Indiana Paleontology, Part VI.
 New Albany, Ind., pp. 42-49, pls. 16-18, 1901.
 Describes Devonian fossils from Indiana.

320 — Contribution to Indiana Paleontology. Part VII.
 New Albany, Ind., pp. 50-61, pls. 19-21, 1901.
 Describes Devonian and Carboniferous fossils from Indiana.

321 — Contribution to Indiana Paleontology. Part VIII.
 New Albany, Ind., pp. 62-74, pls. 22-24, 1901.
 Describes fossils from upper Paleozoic rocks.

322 **Gregory** (Herbert E.). Andesites of the Aroostook volcanic area of Maine.
 Yale Bicentennial publications. Cont. to Mineral. and Petrog., pp. 467-480, 1901. (From Am. Jour. Sci., 4th ser., vol. 8, pp. 359-369.)

323 — [Review of "Physical geography of the Texas region," by R. T. Hill.]
 Am. Jour. Sci., 4th ser., vol. 11, pp. 90-91 (1 p.), 1901.

324 — [Review of "The Pleistocene geology of the south central Sierra Nevada with special reference to the origin of Yosemite Valley," by H. W. Turner.]
 Am. Jour. Sci., 4th ser., vol. 11, pp. 242-243, 1901.

325 **Gregory** (Herbert E.). [Review of "Geology of the Boston basin, vol. 1, Part III. The Blue Hills Complex," by W. O. Crosby.]

Am. Jour. Sci., 4th ser., vol. 11, p. 324, 1901.

326 **Gregory** (J. W.) The plan of the earth and its causes.

Am. Geol., vol. 27, pp. 100-119, figs. 1-5, and 134-147, pls. 12-14, figs. 1-16, 1901.

Reviews previous discussions as to the origin of the distribution of the irregularities in the surface of the lithosphere and discusses the pentagonal theory of Élie de Beaumont and the tetrahedral of Green.

327 **Gresley** (W. S.). Possible new coal plants, etc., in coal.

Am. Geol., vol. 27, pp. 6-14, pls. 2-7, 1901.

Describes structures occurring in coal beds which may be of vegetable origin.

328 **Griffith** (William). An investigation of the buried valley of Wyoming [Pennsylvania].

Wyoming Hist. and Geol. Soc., Proc. and Coll., vol. 6, pp. 27-36, with map, 1901.

Abstract: Am. Geol., vol. 28, p. 324, (§ p.), 1901.

Describes glacial phenomena of the region.

329 **Grimsley** (G. P.). Kansas mines and minerals.

Kans. Acad. Sci., Trans., vol. 17, pp. 200-207, 1901.

Gives an account of the occurrence of the various economic products of the State.

330 **Hague** (Arnold). Note sur les phénomènes volcaniques Tertiaires de la chaîne d'Absaroka [Wyoming].

Int. Cong. Geol., Compte Rendu, viii session, pp. 364-365, 1901.

331 **Hall** (Christopher W.). Sources of the constituents of Minnesota soils.

Minn. Acad. Nat. Sci., Bull. No. 3, pp. 388-406, 2 figs., 1901.

332 — Keweenawan area of eastern Minnesota.

Geol. Soc. Am., Bull., vol. 12, pp. 313-342, pls. 27-28, figs. 1-3, 1901.

Describes the topography and physiography, relations, associated formations, the occurrence of the Keweenawan rocks and the general characters and petrography of the Chengwatana series.

333 — Keewatin area of eastern and central Minnesota.

Geol. Soc. Am., Bull., vol. 12, pp. 343-376, pls. 29-32, 1901.

Describes the occurrence of the series at various localities and their megascopic and microscopic characters. Discusses the evidences as to the age of the series.

334 **Hallock** (William). Peculiar effects due to a lightning discharge on Lake Champlain in August, 1900.

Jour. Geol., vol. 9, pp. 671-672, 1901.

Describes the effect upon the rocks struck by the discharge.

335 **Halse** (Edward). Some silver-bearing veins of Mexico.
North of Eng. Inst. of Mg. & Mch. Engrs., Trans., vol. 50, pp. 202-217, 1901.
Contains brief notes on the vein systems of various mines.

336 **Hamilton** (S. Harbert). Troost's survey of Philadelphia.
Am. Geol., vol. 27, pp. 41-42 ($\frac{1}{2}$ p.), 1901.
Calls attention to the location of a copy of Dr. Gerard Troost's publication on the survey of the environs of Philadelphia.

337 — and **Withrow** (James R.). The progress of mineralogy in 1899, an analytical catalogue of the contributions to that science during the year.
Am. Inst. Mg. Engrs., Bull. No. 2, 1900. (Not seen.)
Abstract: Am. Geol., vol. 27, p. 48 ($\frac{1}{2}$ p.), 1901.

338 **Hanks** (Henry G.). The deep-lying auriferous gravels and table mountains of California.
San Francisco, 15 pp., 6 pls., 1901. (Not seen.)

339 **arrington** (B. J.). George Mercer Dawson.
Am. Geol., vol. 28, pp. 67-76, pl. 9, 1901.
Describes the life and work of Dr. Dawson.

340 **Harris** (Gilbert D.). Oil in Texas.
Science, new ser., vol. 13, pp. 666-667, 1901.
Contains notes on the thickness of the Tertiary in the vicinity of Beaumont.

341 **Haseltine** (R. M.). Lignite deposits or fields of brown coal in North Dakota.
Mines and Minerals, vol. 21, pp. 545-546, 1901.
Describes character and occurrence of the lignite beds.

342 **Hatcher** (J. B.). Diplodocus Marsh, its osteology, taxonomy and probable habits, with a restoration of the skeleton.
Carnegie Mus., Mem. vol. 1, No. 1, pp. 1-63, pls. 1-13, figs. 1-24, 1901.
Abstract: Science, new ser., vol. 14, pp. 531-532, 1901.

343 — On the cranial elements and the deciduous and permanent dentations of Titanotherium.
Carnegie Mus., Annals, vol. 1, pp. 256-262, pls. 7-8, 1901. (Not seen.)

344 — *Sabal rigida*; a new species of palm from the Laramie.
Carnegie Mus., Annals, vol. 1, pp. 263-264, 1901. (Not seen.)

345 — The Jurassic dinosaur deposits near Canyon City, Colorado.
Carnegie Mus., Annals, vol. 1, pp. 327-341, 1901. (Not seen.)

346 — Some new and little known fossil vertebrates.
Carnegie Mus., Annals, vol. 1, 1901. (Not seen.)
Abstract: Am. Geol., vol. 27, p. 379, 1901.

347 **Hatcher** (J. B.). On the structure of the manus in *Brontosaurus*.
Science, new ser., vol. 14, pp. 1015-1017, 1901.

348 **Hawes** (George W.). On a group of dissimilar eruptive rocks
in Campton, New Hampshire.

Yale Bicentennial publications, Cont. to Mineral. and Petrog., pp.
394-399, 1901. (From Am. Jour. Sci., 3d ser., vol. 17, pp. 147-151,
1879.)

349 — The Albany granite, New Hampshire, and its contact
phenomena.

Yale Bicentennial publications. Cont. to Mineral. and Petrog., pp.
400-414, 1901. (From Am. Jour. Sci., 3d ser., vol. 21, pp. 21-32, 1881.)

350 **Haworth** (Erasmus). The Galena-Joplin lead and zinc district.

Min. Ind. for 1899, pp. 658-668, 2 figs., 1900.

Describes the general geology of the region and the occurrence of the
ores.

351 — Petroleum and natural gas in Kansas.

Eng. and Mg. Jour., vol. 72, p. 397, 1901.

Describes the geographic and geologic distribution of the oil and gas.

352 **Hay** (O. P.). [Review of "Beitrag zur systematik und Genealogie
der Reptilien" by Max Furbringer.]

Science, new ser., vol. 14, pp. 180-181, 1901.

353 — The chronological distribution of the elasmobranchs.

Am. Phil. Soc., Trans., new ser., vol. 20, pp. 63-75, 1901.

354 **Hayden** (Horace Edwin). Mr. Ralph Dupuy Lacoë.

Wyoming Hist. and Geol. Soc., Proc. and Coll., vol. 6, pp. 39-54, 1901.

Am. Geol., vol. 28, pp. 335-344, pl. 32, 1901.

Gives a sketch of his life.

355 **Hayes** (Charles Willard). Geological relations of the iron-ores
in the Cartersville district, Georgia.

Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 403-419, figs. 1-2, 1901.

Describes the stratigraphy and structure of the region and the char-
acter and occurrence of the iron, with notes on the occurrence of ocher
and manganese.

356 — The Arkansas bauxite deposits.

U. S. Geol. Surv., 21st Ann. Rept., Pt. III, pp. 435-472, pls. lx-lxiv,
1901.

Abstract: Jour. Geol., vol. 9, pp. 737-739, 1901.

Describes the general geologic and physiographic relations of the
region, and the character, occurrence and origin of the bauxite deposits.

357 — Tennessee white phosphate.

U. S. Geol. Surv., 21st Ann. Rept., Pt. III, pp. 473-485, pl. lxv, 1901.

Describes the character, occurrence and origin of the phosphates of
Perry County.

358 **Heilprin (A.).** Fossils and their teachings.

Sci. Am. Suppl., vol. 52, pp. 21472-21473, 1901.

Lecture delivered before the Philadelphia Academy of Natural Sciences.

359 —— How to interpret the facts of geology.

Sci. Am. Suppl., vol. 52, pp. 21488-21489, 1901.

Abstract of lecture delivered before the Philadelphia Academy of Natural Sciences.

360 **Heiney (Wm. M.).** River bends and bluffs [Indiana].

Ind. Acad. Sci., Proc. for 1900, pp. 197-200, 3 figs, 1901.

361 **Hershey (Oscar H.).** Peneplains of the Ozark Highlands.

Am. Geol., vol. 27, pp. 25-41, 1901.

Describes the Cretaceous and Tertiary peneplains, the Lafayette base level, the Ozarkian valleys and the modern valleys.

362 —— Metamorphic formations of northwestern California.

Am. Geol., vol. 27, pp. 225-245, 1901.

Describes the character, occurrence, and distribution of the pre-Cretaceous rocks of the Klamath Mountains.

363 —— On the age of certain granites in the Klamath Mountains.

Am. Geol., vol. 27, pp. 258-259, 1901.

Brief discussion of the geology of the region and of the intrusive origin of the granite.

364 —— The age of the Kansan drift sheet.

Am. Geol., vol. 28, pp. 20-25, 1901.

Describes the occurrence of the Kansan drift in Missouri and discusses its age.

365 —— The geology of the central portion of the Isthmus of Panama.

Univ. of Cal., Dept. of Geol., Bull., vol. 2, pp. 231-267, and map, 1901.

Describes the physiographic features and the occurrence and character of several formations. Discusses the relations of the crust movements of the region.

366 —— On the age of certain granites in the Klamath Mountains [California].

Abstracts: Jour. Geol., vol. 9, pp. 76-77, 1901; Geol. Soc. Am., Bull., vol. 12, p. 501 (3 p.), 1901.

Contains notes on the occurrence of the granites and on the geologic history of the region.

367 —— An unusual type of auriferous deposit.

Science, new ser., vol. 13, pp. 869-871, 1901.

Describes occurrence of gold in a semidecomposed rock mass in California and discusses the mode of deposition of the gold.

368 **Hilgard (E. W.).** A historical outline of the geological and agricultural survey of the State of Mississippi.

Am. Geol., vol. 27, pp. 284-311, 1901.

Gives an account of the work of this organization and a list of its publications.

369 **Hilgard** (E. W.). A sketch of the pedalogical geology of California.

Abstracts: *Jour. Geol.*, vol. 9, pp. 74-75, 1901; *Geol. Soc. Am., Bull.*, vol. 12, pp. 499-500, 1901.

General notes on the soils of the state.

370 **Hill** (B. F.), **Kemp** (J. F.) and. Preliminary report on the pre-Cambrian formations in parts of Warren, Saratoga, Fulton, and Montgomery counties (New York.)

See *Kemp* (J. F.) and *Hill* (B. F.), 421.

371 **Hill** (Robert T.). [Review of "A record of the geology of Texas for the decade ending December 31, 1896," by Frederic W. Simonds.]

Science, new ser., vol. 13, pp. 226-227, 1901.

372 — The coast prairie of Texas.

Science, new ser., vol. 14, pp. 326-328, 1901.

Describes the evidences of differential movements in this region and its bearing on the occurrence of oil.

373 — Geographic and geologic features of Mexico.

Eng. & Mg. Jour., vol. 72, pp. 561-564, 2 figs., 1901.

Describes the physiography and geology of the country.

374 **Hills** (R. C.). Spanish Peaks folio—Colorado.

U. S. Geol. Surv., *Geol. Atlas of U. S.*, Folio No. 71, 1901.

Describes the geographic features, the character and occurrence of the Cretaceous, Eocene and Neocene strata, the geologic structure, the igneous rocks, and the occurrence of coal and artesian water.

375 **Hitchcock** (C. H.). Tuff cone at Diamond Head, Hawaiian Islands.

Abstracts: *Geol. Soc. Am., Bull.*, vol. 12, p. 462 (1 p.), 1901; *Science, new ser.*, vol. 13, p. 981 (1 p.), 1901.

376 **Hobbs** (William Herbert). The Newark system of the Pomperaug Valley, Connecticut.

U. S. Geol. Surv., 21st Ann. Rept., Pt. III, pp. 7-160, pls. i-xvii, figs. 1-59, 1901.

Gives a sketch of present knowledge regarding this system, describes the character of the sedimentary and igneous rocks, and discusses the deformation and degradation of the region.

377 — The river system of Connecticut.

Jour. Geol., vol. 9, pp. 469-485, pls. 1-2, figs. 1-2, 1901.

Describes the occurrence and origin of the jointing and faulting in the Pomperaug Valley, the occurrence of certain intersecting series of parallel lines called troughs, which occupy the drainage channels for varying distances.

378 — Diamondiferous deposits in the United States.

Min. Ind. for 1900, pp. 301-304, 1901.

Briefly describes occurrence and distribution.

379 **Hobbs** (William Herbert). Connecticut rivers.
Science, new ser., vol. 14, pp. 1011-1012, 1901.
Discusses a recent review by W. M. Davis.

380 **Hoffmann** (G. Christian). Report of the section of chemistry and mineralogy.
Can. Geol. Surv., new ser., vol. 11, Rept. R., 55 pp., 1901. Published in 1900.

381 —— On some new mineral occurrences in Canada.
Am. Jour. Sci., 4th ser., vol. 11, pp. 149-154, 1901.

382 —— On some new mineral occurrences in Canada.
Am. Jour. Sci., 4th ser., vol. 12, pp. 447-448, 1901.
Describes datolite and faujasite.

383 **Holder** (Charles F.). A remarkable salt deposit.
Sci. Am., vol. 84, p. 217, 2 figs., 1901.
Describes occurrence of salt on the Salton desert in California.

384 —— Erosion on the Pacific Coast.
Sci. Am., vol. 85, p. 8, 3 figs., 1901.
Describes some of the physiographic features of the California Coast.

385 **Hollick** (Arthur). A reconnaissance of the Elizabeth Islands [Massachusetts].
N. Y. Acad. Sci., Annals, vol. 13, pp. 387-418, pls. 8-15, 1901.
Describes the physiographic and glacial features of the region.

386 —— Discovery of a mastodon's tooth and the remains of a boreal vegetation in a swamp on Staten Island, N. Y.
N. Y. Acad. Sci., Annals, vol. 14, pt. 1, pp. 67-68, 1901.

387 —— Eocene plantæ.
Md. Geol. Surv., Eocene, pp. 258-261, pl. 64, 1901.

388 **Hopkins** (T. C.). A short discussion of the origin of the Coal Measure fire clays.
Am. Geol., vol. 28, pp. 47-51, 1901.
Reviews the evidences of the formation of fire clays *in situ* and states that the occurrence of a considerable portion of them is better explained by considering them as transported clays reduced before deposition.

389 —— Graphite and garnet.
Mines and Minerals, vol. 21, p. 352, 1901.
Describes occurrence in Pennsylvania and other regions.

390 **Hovey** (E. O.). The Geological Society of America. Thirtieth Annual meeting.
Sci. Am. Suppl., vol. 51, pp. 20948-20950, 1901.
Contains abstracts of papers read.

391 —— Geology and geography at the Denver meeting of the American Association for the Advancement of Science.
Sci. Am. Suppl., vol. 52, pp. 21504-21505, 1901.

392 **Hovey** (E. O.). The Thirtieth Annual Meeting of the Geological Society of America.

Sci. Am., vol. 84, p. 19, 1901.

Contains brief abstract of some of the papers read.

393 — [Abstracts of papers read before the thirtieth annual meeting of the Geological Society of America.]

Eng. and Mg. Jour., vol. 71, pp. 49-50, 1901.

394 — Geology at the fiftieth meeting of the American Association for the Advancement of Science.

Eng. and Mg. Jour., vol. 72, pp. 297-298, 1901.

Contains abstracts of papers read.

395 — Notes on the Triassic and Jurassic strata of the Black Hills of South Dakota and Wyoming.

Abstract: N. Y. Acad. Sci., Annals, vol. 14, p. 152, 1901.

396 — See **Whitfield** (R. P.), 822.

397 **Hovey** (Horace C.). The lead and silver mines of Newbury [Massachusetts].

Sci. Am. Suppl., vol. 51, p. 21284, 1901.

Contains notes on the occurrence of the minerals and the geology of the region.

398 **Howe** (Ernest). Experiments illustrating intrusion and erosion.

U. S. Geol. Surv., 21st Ann. Rept., Pt. III, pp. 291-303, pls. xlv-xlvii, figs. 100-102, 1901.

Describes experiments illustrating the formation of laccoliths and the deformation of the invaded strata.

399 **Hubbard** (George D.). [Review of "Preliminary description of the geology and water resources of the southern half of the Black Hills and adjoining regions in South Dakota and Wyoming" by N. H. Darton, and "The High Plains and their utilization" by Willard D. Johnson.]

Jour. Geol., vol. 9, pp. 732-737, 1901.

400 **Hudson** (Edward J.), **Mabery** (Charles H.) and. On the composition of California petroleum.

See Mabery (C. F.) and Hudson (E. J.), 507.

I.

401 **Ingall** (Elfric Drew). Section of mineral statistics and mines, Annual report for 1898.

Can. Geol. Surv., new ser., vol. 11, Rept. S., 192 pp., 1901. Published in 1900.

Contains statistics of production and notes on the coal fields of Nova Scotia, Manitoba, Northwestern Territories and British Columbia, and on the occurrence of natural gas and oil in Ontario.

J.

402 **Jaggar** (Thomas Augustus). The laccoliths of the Black Hills [South Dakota].

U. S. Geol. Surv., 21st Ann. Rept., Pt. III, pp. 163-290, pls. xviii-xli, figs. 60-99, 1901.

Describes the occurrence of the sedimentary and igneous rocks, and the character, occurrence and distribution of the laccolithic intrusives, and discusses the physiographic form of eroded domes.

403 **Johnson** (D. W.). Notes on the geology of the saline basins of central New Mexico.

Abstract: N. Y. Acad. Sci., Annals, vol. 14, pp. 161-162, 1901.

404 **Johnson** (Willard D.). The high plains and their utilization.

U. S. Geol. Surv., 21st Ann. Rept., Pt. IV, pp. 601-741, pls. cxiii-clvi, figs. 300-329, 1901.

Abstract: Jour. Geol., vol. 9, pp. 734-737, 1901.

Discusses the origin and structure of the region.

405 **Joly** (J.). An estimate of the geological age of the earth.

Smith. Inst., Ann. Rept. 1899, pp. 247-288, 1901.

406 **Jones** (S. P.). The geology of the Tallulah Gorge [Georgia].

Am. Geol., vol. 27, pp. 67-75, pls. 9-11, figs. 1-3, 1901.

Describes the physiographic features of the region and the origin of the gorge.

407 **Julien** (Alexis A.). A study of the structure of fulgurites

Jour. Geol., vol. 9, pp. 673-693, figs. 1-3, 1901.

Gives the results of the study of four fulgurites.

408 — Erosion by flying sand of the beaches of Cape Cod.

Abstract: N. Y. Acad. Sci., Annals, vol. 14, p. 152, 1901.

409 — The geology of central Cape Cod [Massachusetts].

Abstract: Am. Geol., vol. 27, p. 44 (1 p.), 1901.

Contains notes on the glacial phenomena of the region.

410 — [Discussion of paper by J. F. Kemp on "The Cambro-Ordovician outlier at Wellstown, Hamilton County, New York."]

Science, new ser., vol. 13, p. 710, 1901.

Discusses the origin of the sand in the limestones.

K.

411 **Keith** (Arthur). Maynardville folio—Tennessee.

U. S. Geol. Surv., Geol. Atlas of U. S., Folio No. 75, 1901.

Describes the geographic features, the stratigraphy, the character and occurrence of the Cambrian, Silurian, Devonian, and Carboniferous rocks, the geologic structure, and the mineral resources of the region.

412 **Keith (Arthur), Darton (N. H.)** and. Washington Folio, District of Columbia, Maryland, Virginia.
See Darton (N. H.) and Keith (Arthur), 200.

413 **Kemp (James Furman).** The Albany meeting of the Geological Society of America.
Science, new ser., vol. 13, pp. 95-100, 133-139, 1901.
Contains abstracts of papers presented.

414 — The Cambro-Ordovician outlier at Wellstown, Hamilton County, New York.
Abstract: Science, new ser., vol. 13, p. 710, 1901. N. Y. Acad. Sci., Annals, vol. 14, p. 103, 1901.
Contains brief description of occurrence of small outliers of Paleozoic strata within the crystalline area of the region.

415 — [Review of "Clays of New York, their properties and uses" by Heinrich Ries.]
Science, new ser., vol. 13, pp. 946-947, 1901.

416 — New asbestos region in northern Vermont.
Abstract: Science, new ser., vol. 14, pp. 773-774, 1901. N. Y. Acad. Sci., Annals, vol. 14, p. 140, 1901.
Describes the occurrence of asbestos associated with serpentine.

417 — Physiography of Lake George.
Abstract: Science, new ser., vol. 14, p. 774, 1901. N. Y. Acad. Sci., Annals, vol. 14, pp. 141-142, 1901.
Describes briefly the physiographic history of the region.

418 — Calculation of rock analyses.
School of Mines Quart., vol. 22, p. 75, 1901.
Abstract: Am. Nat., vol. 35, p. 947 (½ p.), 1901.

419 — New asbestos region in northern Vermont.
Abstract: Am. Geol., vol. 28, p. 330 (½ p.), 1901.
Abstract of paper read before the N. Y. Academy of Sciences.

420 — Physiography of Lake George, New York.
Abstract: Am. Geol., vol. 28, pp. 331-332, 1901.
Abstract of paper read before the N. Y. Academy of Sciences.

420a — Notes on the occurrence of asbestos in Lamoille and Orleans counties, Vermont.
U. S. Geol. Surv., Min. Res. of U. S. for 1900, pp. 862-866, 1901.

421 — and **Hill (B. F.).** Preliminary report on the pre-Cambrian formations in parts of Warren, Saratoga, Fulton, and Montgomery counties, New York.
N. Y. State Mus., 53d Ann. Rept., pp. r17-r35, pls. 3-8, 1901.
Describes the local geology of various townships of the counties named.

422 **Keyes** (Charles R.). A depositional measure of unconformity.
Geol. Soc. Am., Bull., vol. 12, pp. 173-196, pl. 19, 1901.
Describes the development of the Carboniferous sediments in the Mississippi Valley and Southwestern regions.

423 — Origin and classification of ore deposits.
Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 323-356, 1901.
Discusses the nature of ore deposits, general methods of ore formation, the classification of ore deposits, and certain other phases of ore deposits.

424 — Derivation of the terrestrial spheroid from the rhombic dodecahedron.
Jour. Geol., vol. 9, pp. 244-249, 1901.
Discusses Green's hypothesis of the tetrahedral form of the earth.

425 — Composite genesis of the Arkansas Valley through the Ozark highlands.
Jour. Geol., vol. 9, pp. 486-490, figs. 1-2, 1901.
Discusses the evidences which indicate that there has been but one uplift in the region and that the river eroded its bed as fast as the strata were raised.

426 — [Review of "Uintacrinus; its structure and relations by Frank Springer; "Oriskany fauna of Becroft Mountain" by J. M. Clarke; and "Stratigraphical succession of the fossil floras of the Pottsville formation in the southern Anthracite coal field" by David White.]
Jour. Geol., vol. 9, pp. 539-547, 1901.

427 — [Review of "Zinc and lead region of north Arkansas" by John C. Branner.]
Jour. Geol., vol. 9, pp. 634-636, 1901.

428 — Ore formation on the hypothesis of concentration through surface decomposition.
Am. Geol., vol. 27, pp. 355-362, 1901.
Discusses the evidence as to the derivation of the lead and zinc ores of the Ozark region and their bearing on the origin of ore deposits in general.

429 — Nomenclature of the Cambrian formations of the St. François Mountains [Missouri].
Am. Geol., vol. 28, pp. 51-53, 1901.
Discusses the validity of certain names applied to the Cambrian formations of the region.

430 — [Reviews of "Paleozoic faunas of northern Arkansas" by H. S. Williams; "What is an Echinoderm?" by F. A. Bather; and "Structure and relations of Uintacrinus" by Frank Springer.]
Am. Geol., vol. 28, pp. 254-260, 1901.

431 **Keyes** (Charles R.). A schematic standard for the American Carboniferous.

Am. Geol., vol. 28, pp. 299-305, fig. 1, 1901.

Presents a general section of the Carboniferous of the Mississippi Valley and discusses its correlation with other regions.

432 — [Review of "Geology of eastern Choctaw coal field" by J. A. Taff and G. I. Adams.]

Am. Geol., vol. 28, pp. 318-319, 1901.

433 — Time values of provincial Carboniferous terranes.

Am. Jour. Sci., 4th ser., vol. 12, pp. 305-309, fig. 1, 1901.

Discusses the time ratios of the several subdivisions of the Carboniferous of the Mississippi Valley region.

434 — Note on the correlation of the Clarinda well section with the schematic section of the Carboniferous.

Iowa Geol. Surv., vol. 11, pp. 461-463, 1901.

Compares the well section with the general section.

435 — A depositional measure of unconformity.

Abstract: Science, new ser., vol. 13, pp. 135-136, 1901.

436 — On a crinoidal horizon in the Upper Carboniferous.

Science, new ser., vol. 13, pp. 915-916, 1901.

Describes its occurrence and its bearing on the stratigraphy of the Mississippi Valley.

437 — Zone of maximum richness in ore bodies.

Science, new ser., vol. 14, pp. 577-578, 1901.

Contains abstracts of recent papers by Emmons and Weed.

438 — Horizons of Arkansas and Indian Territory coals compared with those of other trans-Mississippi coals.

Eng. and Mg. Jour., vol. 71, pp. 692-693, 2 figs., 1901.

Discusses the relations of the coal-bearing horizons of the trans-Mississippian region.

439 — The stratigraphical location of named trans-Mississippian coals.

Eng. and Mg. Jour., vol. 72, p. 198, 1901.

Gives list of geological formations and the coals occurring in each.

440 — Contiguity of ore deposits of different generic relationships.

Abstract: Eng. and Mg. Jour., vol. 72, pp. 597-598, 1901.

441 — Diverse origins and diverse times of formation of the lead and zinc deposits of the Mississippi Valley.

Mining and Metallurgy, vol. 24, pp. 715-717, 1901. (Not seen.)

442 **Kindle** (Edward M.). The Devonian fossils and stratigraphy of Indiana.

Ind. Dept. of Geol. and Nat. Res., 25th Ann. Rept., pp. 529-763, pls. i-xxxii, 1901.

Reviews the nomenclature of the formations and describes the lithologic and faunal character of many sections, and the characters of a large number of fossils from the Devonian rocks of the State. Discusses the correlation of the formations.

443 **Kingsley** (J. S.). The origin of the Mammals.

Science, new ser., vol. 14, pp. 193-205, figs. A-E, 1901.

444 **Knapp** (S. A.). Tonopah [Nevada].

Mg. and Sci. Press., vol. 82, p. 231, 1901.

Describes occurrence of gold and silver at this locality.

445 **Knight** (Nicholas). Some Iowa dolomites.

Am. Jour. Sci., 4th ser., vol. 11, pp. 244-246, 1901.

Contains chemical analyses of the dolomites.

446 **Knight** (W. C.). Description of Bates Hole [Wyoming].

Abstracts: Jour. Geol., vol. 9, pp. 70-71, 1901. Geol. Soc. Am., Bull., vol. 12, pp. 495-496, 1901.

Describes the physiographic and geologic features of the region.

447 — The petroleum fields of Wyoming.

Eng. and Mg. Jour., vol. 72, pp. 358-359, and map, 628-630, 4 figs., 1901.

Describes the geology and character and occurrence of the oil in the several oil-bearing districts of the State.

448 — The Sweetwater mining district, Fremont County, Wyoming.

Wyom. Univ., School of Mines, 35 pp., 1 map, 1901.

Describes occurrence of gold in this district.

449 — Geology of the oil fields [Wyoming].

Wyom. Univ., School of Mines, Bull. No. 4, 1901. (Not seen.)

450 — and **Slosson** (E. E.). The Dutton, Rattlesnake, Arago, Oil

Mountain, and Powder River oil fields [Wyoming].

Wyom. Univ., School of Mines, Pet. ser., Bull. No. 4, 57 pp., 1 fig., 2 maps, 1901.

Describes the occurrence and character of the oils in the several districts.

451 — Alkali lakes and deposits [Wyoming].

Wyom. Univ., Exp. Stat., Bull. No. 49, 123 pp., 1 map, 1901.

Describes the character, occurrence, and origin of the deposits of considerable depth.

452 **Knowlton** (Frank Hall). [Report on the Clarno flora, Oregon.]

Univ. of Cal., Dept. of Geol., Bull., vol. 2, pp. 287-291, 1901.

Gives list of fossil plants collected.

453 **Knowlton** (Frank Hall). [Report on the flora of the Mascall formation, Oregon.]

Univ. of Cal., Dept. of Geol., Bull., vol. 2, pp. 308-309, 1901.
Gives list of fossils collected.

454 — Report on fossil wood from the Newark formation of South Britain, Connecticut.

U. S. Geol. Surv., 21st Ann. Rept., Pt. III, pp. 161-162, 1901.
Briefly describes material.

455 **Kümmel** (Henry B.). Report on Portland cement industry. [New Jersey.]

N. J. Geol. Surv., Ann. Rept. for 1900, pp. 9-101, pls. 1-11, figs. 1-33, 1901.

Describes the composition of Portland cement, and the character and occurrence of the lower Paleozoic rocks from which the materials are derived. Includes detailed descriptions of localities.

456 — The mining industry. [New Jersey.]

N. J. Geol. Surv., Ann. Rept. for 1900, pp. 197-217, 1901.
Contains statistics and notes on iron, zinc, and copper.

457 — and **Weller** (Stuart). Paleozoic limestones of Kittatinny Valley, New Jersey.

Geol. Soc. Am., Bull., vol. 12, pp. 147-164, 1901.

Abstract: Science, new ser., vol. 13, p. 134, 1901.

Describes the lithologic and faunal characters of the subdivisions of the Cambrian and Ordovician series and the structure of the region.

458 **Kunz** (George F.). Des progrès de la production des pierres précieuses aux États-Unis.

Int. Cong. Geol., Compte Rendu, viii session, pp. 393-395, 1901.

L.

459 **Laflamme** (J. C. K.). Modifications remarquables causées à l'Embouchere de la Rivière Ste-Anne par l'eboulement de St-Alban.

Can. Roy. Soc., Proc. and Trans., new ser., vol. 6, sect. 4, pp. 175-177, 1900.

460 — Eboulement à Saint-Luc-de-Vincennes, Rivière Champlain, le 21 Septembre, 1895.

Can. Roy. Soc., Proc. and Trans., new ser., vol. 6, sect. 4, pp. 179-186, 1 fig., 1900.

461 **Lakes** (Arthur). The American Nettie [Colorado].

Mines and Minerals, vol. 21, pp. 241-245, 5 figs., 1901.

Describes the geology of the region and the occurrence of ores in cave deposits.

462 — Cripple Creek [Colorado].

Mines and Minerals, vol. 21, pp. 276-280, 7 figs., 1901.

Describes volcanic rocks and phenomena of the region.

463 Lakes (Arthur). The Curtis coal mine [Colorado].

Mines and Minerals, vol. 21, p. 298 (1 p.), 1901.

Brief description of occurrence and character of coal near Colorado Springs.

464 —— Cave ore deposits [Colorado].

Mines and Minerals, vol. 21, pp. 333-334, 1 fig., 1901.

Describes character and occurrence of ore bodies in the San Juan region.

465 —— The Cerrillos anthracite mines [New Mexico].

Mines and Minerals, vol. 21, pp. 341-342, 1901.

Describes character and occurrence of coal in this region.

466 —— A new coal field [New Mexico].

Mines and Minerals, vol. 21, pp. 375-376, 2 figs., 1901.

Describes the geology of the region and the occurrence of coal.

467 —— The turquoise mines [New Mexico].

Mines and Minerals, vol. 21, pp. 395-396, 1901.

Describes occurrence of turquoise.

468 —— Change of ore bodies with change of country rock.

Mines and Minerals, vol. 21, p. 417, 1901.

Discusses some phenomena accompanying ore deposition.

469 —— Peculiar geological formations of the Southern States.

Mines and Minerals, vol. 21, p. 430, 1901.

Contains notes on the general geology of the region.

470 —— Oil fields of California.

Mines and Minerals, vol. 21, pp. 467-470, 2 figs., 1901.

Describes the general geology of southern California and the occurrence of oil.

471 —— Prospecting for oil in Colorado.

Mines and Minerals, vol. 21, pp. 481-483, 4 figs., 1901.

Describes general geology and occurrence of oil in Colorado.

472 —— Building and monumental stones of Colorado.

Mines and Minerals, vol. 22, pp. 29-30, 5 figs., 1901.

Describes the general characters and occurrence of various building stones.

473 —— Sedimentary building stones of Colorado.

Mines and Minerals, vol. 22, pp. 62-64, 5 figs., 1901.

Describes occurrence and character of building stones from sedimentary strata.

474 —— Petroleum in western North America.

Mines and Minerals, vol. 22, pp. 78-80, 1901.

Describes the occurrence of oil in this region.

475 **Lakes** (Arthur). Prospecting for oil in Colorado.

Mines and Minerals, vol. 22, pp. 107-109, 5 figs., 1901.
Contains notes on the occurrence of oil.

476 — Oil springs of Rio Blanco County, Colorado.

Mines and Minerals, vol. 22, pp. 150-152, 5 figs., 1901.
Describes the geologic structure and occurrence of oil.

477 — Some Idaho mining districts.

Mines and Minerals, vol. 22, pp. 203-206, 5 figs., 1901.
Contains notes on the geology of the State and the character and occurrence of ore bodies.

478 — The geological occurrence of oil in Colorado.

Abstract: Sci. Am. Suppl., vol. 52, p. 21505, 1901.

479 **Lambe** (L. M.). A revision of the general and species of Canadian Paleozoic corals. The *Madreporia aporosa* and *rugosa*.

Can. Geol. Surv., Cont. to Can. Paleont., vol. 4, pt. 2, pp. 97-198, pls. 6-18, 1901.
(Not seen.)

480 **Lane** (Alfred C.). Michigan limestones and their uses.

Eng. & Mg. Jour., vol. 71, pp. 662-663, 1 fig., 693-694, and 725, 1901.
Describes the occurrence, character and uses of the limestones derived from the several geologic horizons in Michigan.

481 — The pre-Glacial surface deposits of Lower Michigan.

Abstract: Science, new ser., vol. 14, pp. 788-799, 1901.
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482 **Lawson** (Andrew C.). A feldspar-corundum rock from Plumas County, California.

Abstracts: Jour. Geol., vol. 9, p. 78 (½ p.), 1901. Geol. Soc. Am., Bull., vol. 12, pp. 501-502 (½ p.), 1901.
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483 — The drainage features of California.

Abstracts: Jour. Geol., vol. 9, pp. 77-78, 1901. Geol. Soc. Am., Bull., vol. 12, p. 495 (¾ p.), 1901.
Discusses the causes which have determined the drainage features of the Coast, Klamath and Sierra Nevada ranges.

484 — **Joseph Le Conte**.

Science, new ser., vol. 14, pp. 273-277, 1 pl., 1901.
Gives a sketch of his life and work.

484a — and **Palache** (Charles). The Berkeley Hills [California]. A detail of Coast Range geology.

Univ. of Cal., Dept. of Geol., Bull., vol. 2, pp. 349-450, pls. 10-17, and map, 1901.
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Jedoux (A. R.). Notes on the Oregon nickel prospects.
Can. Mg. Rev., vol. 20, pp. 84-85, 1901.
Can. Mg. Inst., Jour., vol. 4, pp. 184-189, 1901.
Describes the geological relations of the ore bodies and gives a chemical analysis of the ore.

7 Lee (Willis T.). The Morrison formation of southwestern Colorado.
Jour. Geol., vol. 9, pp. 343-352, figs. 1-4, 1901.

Describes the character and occurrence of the Jurassic and Cretaceous strata of the region, and discusses the stratigraphic and paleontologic evidences of the age of the Morrison formation.

488 L'Home (Wm. E.). Thunder Mountain, Idaho.

Mines and Minerals, vol. 21, p. 558, 1901.
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489 Leith (C. K.). Summaries of current North American pre-Cambrian literature.

Jour. Geol., vol. 9, pp. 79-87, and 441-458, 1901.

490 — Van Hise (C. R.) and. The Mesabi district.

See Van Hise (C. R.), 759.

491 Leonard (Arthur Gray). The basic rocks of northwestern Maryland and their relation to the granite.

Am. Geol., vol. 28, pp. 135-176, pls. 15-19, 1901.
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492 LeRoy (Osmond Edgar). Geology of Rigaud Mountain, Canada.

Geol. Soc. Am., Bull., vol. 12, pp. 377-394, pls. 33-34, 1901.
Abstract: Science, new ser., vol. 13, pp. 136-137, 1901.
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493 Letson (Elizabeth J.). Post-Pliocene fossils of the Niagara River gravels.

Buffalo Soc. Nat. Sci., Bull., vol. 7, pp. 238-252, figs. 161-190, 1901.

494 Leverett (Frank). Old channels of the Mississippi in southeastern Iowa.

Annals of Iowa, April, 1901. (Not seen.)

495 Lindgren (Waldemar). Metasomatic processes in fissure veins.

Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 578-692, fig. 1-30, 1901.
Am. Jour. Sci., 3d ser., vol. 11, pp. 243-244 (1 p.), 1901.
Features of the changes in rocks contiguous to

496 **Lindgren** (Waldemar). *Trias in northeastern Oregon.*

Abstract: *Science, new ser., vol. 13, pp. 270-271, 1901.*
Describes briefly character and distribution.

497 — Rare minerals in gold quartz veins of eastern Oregon.

Mg. and Sci. Press., vol. 82, p. 252, 1901.
Gives a chemical analysis of roscoelite and notes on other minerals.

498 **Loomis** (F. B.). *On Jurassic stratigraphy in southeastern Wyoming.*

Am. Mus. Nat. Hist., Bull., vol. 14, pp. 189-197, pls. 26-27, 1901.
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501 **Lucas** (Frederic A.). *A new rhinoceros, Trigonias osborni, from the Miocene of South Dakota.*

U. S. Nat. Mus., Proc., vol. 23, pp. 221-223, figs. 1-2, 1901.

502 — *A new dinosaur, Stegosaurus marshi, from the Lower Cretaceous of South Dakota.*

U. S. Nat. Mus., Proc., vol. 23, pp. 291-292, pls. 23-24, 1901.

503 — *The pelvic girdle of Zeuglodon, Basilosaurus cetoides (Owen), with notes on other portions of the skeleton.*

U. S. Nat. Mus., Proc., vol. 23, pp. 327-331, pls. 5-7, 1901.
Includes section of the Zeuglodon beds.

504 — *A new fossil Cyprinoid, Leuciscus turneri, from the Miocene of Nevada.*

U. S. Nat. Mus., Proc., vol. 23, pp. 333-334, pls. 8, 1901.

504a — *A flightless Auk, Mancalla californiensis, from the Miocene of California.*

U. S. Nat. Mus., Proc., vol. 24, pp. 133-134, 3 figs., 1901.

505 — *Vertebrates from the Trias of Arizona.*

Science, new ser., vol. 14, p. 376, 1901.
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506 **Lyon** (D. A.). *Serpentine marbles of Washington.*

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507 **Mabery** (Charles F.) and **Hudson** (Edward J.). On the composition of California petroleum.
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 Ind. Acad. Sci., Proc. for 1900, pp. 184-192, 2 figs., 1901.
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509 —— A theory to explain the western Indiana boulder belts
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510 **Macbride** (Thomas H.). Geology of Clay and O'Brien counties [Iowa].
 Iowa Geol. Surv., vol. 11, pp. 463-497, figs. 38-39, and map, 1901.
 Describes physiography, the occurrence and character of the Pleistocene beds and the occurrence of economic products.

511 **McCalley** (Henry). The Alabama coal fields.
 Mines and Minerals, vol. 21, pp. 446-449, 3 figs., 1901.
 Describes the general occurrence and character of the coal.

512 **McCallie** (S. W.). A preliminary report on the roads and road-building materials of Georgia.
 Ga. Geol. Surv. Bull. 8, 264 pp., pls. 13-14, 1901. (Not seen.)

513 —— Some notes on the trap dikes of Georgia.
 Am. Geol., vol. 27, pp. 133-134, pls. 12-14, 1901.
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514 **McCaslin** (D. S.). The geology of the artesian basin in South Dakota.
 Minn. Acad. Nat. Sci., Bull., vol. 3, pp. 380-388, 1901.

515 **McCormick** (E.). The Santa Fe mining district, Nevada.
 Mines and Minerals, vol. 21, p. 407 ($\frac{1}{2}$ p.), 1901.
 Describes the geologic structure of the region and the occurrence of copper and silver ores.

516 **McEvoy** (James). Report on the geology and natural resources of the country traversed by the Yellow Head Pass route from Edmonton to Tete Jaune Cache, comprising portions of Alberta and British Columbia
 Can. Geol. Surv., new ser., vol. 11, Rept. D, 44 pp., pl. 2, 1901. Published in 1900.
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517 **McNairn** (W. Harvey). On a large phlogopite crystal.

Am. Jour. Sci., 4th ser., vol. 12, p. 398 (3 p.), 1901.

Briefly describes character and occurrence.

518 **Malcohnsen** (James W.). The Sierra Mojada, Coahuila, Mexico, and its ore deposits.

Eng. and Mg. Jour., vol. 72, pp. 705-710, figs. 1-5, 1901.

Contains notes on the geology and ore bodies of the region.

519 **Manning** (P. C.). Glacial potholes in Maine.

Portland Soc. Nat. Hist., Proc., vol. 2, pp. 185-200, pls. 3-4, 1901.

Describes the occurrence and character of the potholes along the coast of Maine and discusses the evidences indicating their origin.

520 **Martin** (Daniel S.). [Minerals at Haddam, Maine.]

Abstract: Am. Geol., vol. 27, p. 44 (6 l.), 1901.

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521 —— Geological notes on the neighborhood of Buffalo.

Abstract: N. Y. Acad. Sci., Annals, vol. 14, pp. 162-163, 1901.

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See Clark (W. B.) and Martin (G. C.), 143.

523 —— —— Eocene Molluscoidea (Brachiopoda).

See Clark (W. B.) and Martin (G. C.), 142.

524 —— —— Eocene Mollusca.

See Clark (W. B.) and Martin (G. C.), 141.

525 —— —— The Eocene deposits of Maryland.

See Clark (W. B.) and Martin (G. C.), 140.

526 **Martin** (J. O.). The Ontario coast between Fairhaven and Sodus bays [New York].

Am. Geol., vol. 27, pp. 331-334, pls. 26-27, 1901.

Describes the lake shore phenomena of the region.

527 **Martin** (K.). Ueber Tertiare fossilen von der Philippinen.

See Becker (George F.), 50.

528 **Mason** (F. H.). Potters clay at Middle Musquodoboit [Nova Scotia].

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529 **Matthew** (George F.). Preliminary notice of the Etcheminian fauna of Newfoundland.

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530 **Matthew** (George F.). Preliminary notice of the Etcheminian fauna of Cape Breton.

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531 —— *Acrothyra* and *Hyolithes*—a comparison.

Can. Roy. Soc., Proc. and Trans., vol. 7, sect. 4, pp. 93-106, 1901.
(Not seen.)

Abstract: Science, new ser., vol. 13, p. 1018 ($\frac{1}{2}$ p.), 1901.

532 —— *Hyolithes gracilis*, and related forms from the Lower Cambrian of the St. John group.

Can. Roy. Soc., Proc. and Trans., vol. 7, sect. 4, pp. 109-111, 1901.
(Not seen.)

533 —— [Devonian of the Acadian provinces.]

Can. Rec. Sci., vol. 8, pp. 344-345, 1901.

Discusses recent papers by David White.

534 —— [Review of "Beitrage zur Kenntniss des Siberischen Cambrium I," by E. von Toll.]

Am. Geol., vol. 27, pp. 54-56, 1901.

535 —— Are the St. John plant beds Carboniferous?

Am. Geol., vol. 27, pp. 383-386, 1901.

Discusses the stratigraphic and faunal evidences of the age of the beds.

536 —— Les plus anciennes faunes Paleozoiques.

Int. Cong. Geol., Compte Rendu, viii session, pp. 313-316, 1901.

Gives a résumé of what is known regarding the earliest faunas of eastern Canada.

537 —— A backward step in Paleobotany.

Abstract: Science, new ser., vol. 13, p. 1019 ($\frac{1}{2}$ p.), 1901.

Paper read before the Royal Society of Canada.

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Am. Mus. Nat. Hist., Bull., vol. 14, pp. 1-38, figs. 1-17, 1901.

Discusses the classification of the group and revision of genera.

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Am. Jour. Sci., 4th ser., vol. 11, p. 473 ($\frac{1}{2}$ p.), 1901.

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Kans. Acad. Sci., Trans., vol. 17, pp. 207-208, 1901.

Discusses the origin of these hills.

541 **Memminger** (C. G.). Progress in the phosphate mining industry of the United States during 1900.

Min. Ind. for 1900, pp. 513-518, 1901.

Describes occurrence of phosphate in several States.

542 **Merriam** (John C.). A contribution to the geology of the John Day basin [Oregon].

Univ. of Cal. Dept. of Geol., Bull., vol. 2, pp. 269-314, pls. 6-8, fig. 1, 1901.

Gives a sketch of previous explorations and literature of the region, and describes the classification, character, occurrence, relations, and faunas of the Cretaceous, Tertiary, and Pleistocene strata.

543 — A geological section through the John Day basin [Oregon].

Abstracts: Jour. Geol., vol. 9, pp. 71-72, 1901; Geol. Soc. Am., Bull., vol. 12, pp. 496-497, 1901.

Describes the character and occurrence of the John Day beds and the associated strata.

544 **Merrill** (George P.). The Department of Geology in the National Museum.

Am. Geol., vol. 28, pp. 107-123, pls. 10-14, 1901.

Gives an account of the methods employed in caring for and rendering available to students the materials in charge of this department of the Museum, and in displaying the same for the benefit of the public.

544a — On a stony meteorite which fell near Felix, Perry County, Alabama, May 15, 1901.

U. S. Nat. Mus., Proc., vol. 24, pp. 193-198, pls. xiii-xiv, 1901.

545 — Guide to the study of the collections in the section of applied geology—the nonmetallic minerals [U. S. National Museum].

U. S. Nat. Mus., Ann. Rept. for 1899, pp. 156-483, pls. 1-30, figs. 1-13, 1901.

Describes the character, occurrence, and uses of the nonmetallic minerals.

546 — and **Stokes** (H. N.). A new stony meteorite from Allegan, Michigan, and a new iron meteorite from Mart, Texas.

Wash. Acad. Sci., Proc., vol. 2, pp. 41-68, 6 pls., 1900.

Describes the occurrence, characters, and chemical composition of the material.

547 **Miller** (Arthur M.). Preglacial drainage in southwestern Ohio.

Science, new ser., vol. 14, pp. 534-535, 1 fig., 1901.

548 **Miller** (B. L.). Geology of Marion County [Iowa].

Iowa Geol. Surv., vol. 11, pp. 130-197, pl. 5, figs. 9-12 and map, 1901.

Describes the physiography, the character and occurrence of the Carboniferous and Pleistocene deposits and the occurrence of coal.

549 **Miller** (Gerrit S., jr.). Preliminary list of mammals of New York.

N. Y. State Mus., 53rd Ann. Rept., vol. 1, pp. 267-390, 1901.

Contains list of fossil species.

550 **Miller** (Willet G.). On some newly discovered areas of nepheline syenite in central Canada.

Am. Geol., vol. 27, pp. 21-25, 1901.

Describes character and occurrence in Ontario.

551 **Miller** (Willet G.). Iron ores of Nipissing district [Ontario].
 Ontario Bureau of Mines, Rept. for 1901, pp. 160-180, pls. 21-24, 2 figs., 1901.
 Describes the physiography of the region and the occurrence and character of the iron ores in Huronian rocks.

552 — The iron ore fields of Ontario.
 Can. Mg. Rev., vol. 20, pp. 151-158, 3 figs., 1901; Can. Mg. Jour., vol. 4, pp. 265-283, 3 figs., 1901.
 Contains notes on the occurrence and character of iron ore deposits in Ontario.

553 **Miller** (W. W. jr.). Analysis of emery from Virginia.
 Abstract: Am. Geol., vol. 27, pp. 314-315 ($\frac{1}{2}$ p.), 1901.

554 — Examination of sandstone from Augusta County, Virginia.
 Abstract: Am. Geol., vol. 27, p. 315 ($\frac{1}{2}$ p.), 1901.

555 — Analysis of smithsonite from Arkansas.
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556 **Montgomery** (Thomas H.). Missing links.
 Sci. Am. Suppl., vol. 52, pp. 21732-21734, 1901.
 Abstract of lecture delivered at the Wagner Institute, Philadelphia, Pennsylvania.

557 **Morganroth** (L. C.). The caves of Huntington County Pennsylvania.
 Eng. and Mg. Jour., vol. 71, p. 664 ($\frac{1}{2}$ p.), 1901.
 Describes the character of the cave.

558 **Moses** (A. J.). Mineralogical notes.
 Am. Jour. Sci., 4th ser., vol. 12, pp. 98-106, figs. 1-6, 1901.
 Describes crystallographic characters of pectolite, atacamite, realgar, vesuvianite, chrysoberyl, and pyroxene.

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559 **Nansen** (Fridtjof). The Norwegian North Polar expedition, 1893-1896.
 Scientific results, vols. 1-2, 1901. Longmans, Green & Co., London, New York, 1901.
 Review: Jour. Geol., vol. 9, pp. 273-275, 1901.

560 **Nason** (Frank L.). On the presence of a limestone conglomerate in the lead region of St. François County, Missouri.
 Am. Jour. Sci., 4th ser., vol. 11, p. 396 ($\frac{1}{2}$ p.), 1901.
 Brief note announcing discovery of limestone conglomerate between the St. Joseph or Bonne Terre limestone and the Potosi in Missouri.

561 — The geological relations and the age of the St. Joseph and Potosi limestones of St. François County, Missouri.
 Am. Jour. Sci., 4th ser., vol. 12, pp. 358-361, 1901.
 Describes occurrence of a conglomerate between the two formations and gives a columnar section.

562 **Nason** (Frank L.). The origin of vein cavities.
Eng. and Mg. Jour., vol. 71, pp. 177-179, 209-210, 1901.
Discusses the origin of these vein phenomena.

563 **Nevins** (J. N.). Roofing slate quarries of Washington County [New York].
N. Y. State Mus., 53d Ann. Rept., vol. 1, pp. r135-r150, pls. 26-37, 1901.
Describes the slates of the various quarries.

564 —— Emery mines of Westchester County [New York].
N. Y. State Mus., 53d Ann. Rept., vol. 1, pp. r151-r154, pls. 38-41, 1901.

565 **Newland** (D. H.). The serpentines of Manhattan Island and vicinity and their accompanying minerals.
School of Mines Quart., vol. 22, pp. 307-317, 399-410, figs. 1-4, 1901.
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566 **Nichols** (Henry W.). Nitrates in cave earths.
Jour. Geol., vol. 9, pp. 236-243, 1901.
Abstract: Am. Geol., vol. 28, p. 58 (½ p.), 1901.
Reviews paper by William H. Hess on the same subject, gives a number of analyses of soil, limestone, and cave earth and discusses the origin of the nitrates.

567 **Nicolson** (J. T.), **Adams** (Frank D.), and. An experimental investigation into the flow of marble.
See Adams (F. D.) and Nicolson (J. T.), 5.

568 **Norton** (William Harmon). Geology of Cedar County [Iowa].
Iowa Geol. Surv., vol 11, pp. 282-396, pls. 7-12, figs. 16-27, and maps, 1901.
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569 —— The relation of physical geography to other science subjects.
Science, new ser., vol 14, pp. 205-210, 1901.

570 **Nutter** (Edward Hoit). Sketch of the geology of the Salinas Valley, California.
Jour. Geol., vol. 9, pp. 330-336, 8 figs., 1901.
Describes the formation of the valley and the character and occurrence of the Tertiary strata which were laid down in this trough.

571 **Nylander** (Olof O.). Shells of the marl deposits of Aroostook County, Maine, as compared with the living forms in the same locality.
Nautilus, vol. 14, pp. 101-104, 1901.
Gives list of fossils determined.

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572 **Obalski** (J.). Notes on the magnetic iron sand of the north shore of the St. Lawrence [Canada].
 Can. Mg. Rev., vol. 20, pp. 34-37, 1 fig., 1901.
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573 **Ordoñez** (Ezequiel). Las rhyolitas de Mexico. I.
 Mexico Inst. Geol., Bull. No. 14, 75 pp., 5 pls., 1900.
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574 —— La industria minera en Mexico.
 Ciencia y Arte, Mexico, 19 pp., 1901. (Not seen.)

575 —— The mining district of Pachuca, Mexico.
 Eng. and Mg. Jour., vol. 72, pp. 719-721, 1901.
 Contains notes on the geology and mineralization of the region.

576 **Ortmann** (Arnold E.). The theories of the origin of the Antarctic faunas and floras.
 Am. Nat., vol. 35, pp. 139-142, 1901.
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577 **Orton** (Edward). Petroleum and natural gas in New York.
 N. Y. State Mus., 53d Ann. Rept., vol. 1, pp. 391-526, 3 maps, 1901.
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578 **Osborn** (Henry Fairfield). The recent progress of vertebrate paleontology in America.
 Science, new ser., vol. 13, pp. 45-49, 1901.
 Abstract of lecture delivered at Trinity College, Hartford, Conn.

579 —— Recent zoo-paleontology.
 Science, new ser., vol. 14, pp. 330-331, 1901.
 Contains notes on papers relating to the John Day beds and to the Kansas chalk.

580 —— [Review of "Diplodocus Marsh. Its osteology, taxonomy, and probable habits, with the restoration of the skeleton" by J. B. Hatcher.]
 Science, new ser., vol. 14, pp. 531-532, 1901.

581 —— Recent zoo-paleontology.
 Science, new ser., vol. 14, pp. 699-700, 1901.
 Reviews Wortman's work on the Carnivora and Gidley's work on Pleistocene horses.

582 —— Des méthodes précises mises actuellement en œuvre dans l'étude des vertébrés fossiles des États-Unis d'Amérique.
 Int. Cong. Geol., Compte Rendu, viii session, pp. 353-356, pls. i-ii, 1901.

583 **Osborn** (Henry Fairfield). Corrélation des horizons de mammifères Tertiaires en Europe et en Amérique.

Int. Cong. Geol., Compte Rendu, viii session, pp. 357-363, 1901.

584 — Systematic revision of the American Eocene primates and of the rodent family *Myxodectidæ*.

Abstract: N. Y. Acad. Sci., Annals, vol. 14, p. 111, 1901.

585 — and **Granger** (Walter). Fore and hind limbs of Sauropoda from the Bone Cabin quarry [Wyoming].

Am. Mus. Nat. Hist., Bull., vol. 14, pp. 199-208, figs. 1-6, 1901.

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585a **Palache** (Charles), **Lawson** (Andrew C.), and. The Berkeley Hills [California]. A detail of Coast Range geology.

See **Lawson** (A. C.) and **Palache** (C.), 485a.

586 **Parkinson** (John). The hollow spherulites of the Yellowstone and Great Britain.

Lond. Geol. Soc., Quart. Jour., vol. 57, pp. 211-225, pl. 8, figs. 1-4, 1901.

Describes the author's observations in the Yellowstone region and discusses the origin of spherulites.

587 — Some lake basins in Alberta and British Columbia.

Geol. Mag., new ser., dec. iv, vol. 8, pp. 97-101, pl. 4, 1901.

Describes the physiography of the region and the character of the lake basins.

588 **Patton** (H. B.). Abstracts of papers read before Section E of the American Association for the Advancement of Science, August 26-29, 1901.

Science, new ser., vol. 14, pp. 794-800, 1901.

589 **Pearson** (H. W.). Oscillations in the sea-level.

Geol. Mag., new ser., vol. 8, pp. 167-174, 223-231, 253-265, 1901

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590 **Peck** (F. B.). Preliminary notes on the occurrence of serpentine and talc at Easton, Pa.

N. Y. Acad. Sci., Annals, vol. 13, pp. 419-430, pl. 16, figs. 4-5, 1901.

Describes the general geology and structure of the region and the occurrence of the crystalline rocks and the alteration products.

591 **Peckham** (Herbert E.). On the bituminous deposits situated at the south and east of Cardenas, Cuba.

Am. Jour. Sci., 4th ser., vol. 12, pp. 33-41, figs. 1-2, 1901.

Describes the occurrence and extent of these bituminous deposits.

592 **Peckham** (S. F.). [Remarks on paper by Herbert E. Peckham on the bituminous deposits near Cardenas, Cuba.]

Am. Jour. Sci., 4th ser., vol. 12, p. 41 (1 p.), 1901.

593 **Penfield** (Samuel L.). On the chemical composition of *childrenite*.
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594 — On the chemical composition of *amblygonite*.
Yale Bicentennial publications. Cont. to Mineral. and Petrog., pp. 121-123, 1901. (From Am. Jour. Sci., vol. 18, pp. 295-301, 1879.)

595 — On *spangolite*, a new copper mineral.
Yale Bicentennial publications. Cont. to Mineral. and Petrog., pp. 168-175, 1901. (From Am. Jour. Sci., vol. 39, pp. 370-378, 1890.)

596 — — On *pearcite*, a sulpharsenite of silver.
Yale Bicentennial publications. Cont. to Mineral. and Petrog., pp. 252-260, 1901. (From Am. Jour. Sci., vol. 2, pp. 17-20, 1896.)

597 — On the chemical composition of *hamlinite* and its occurrence with *bertrandite* at Oxford County, Maine.
Yale Bicentennial publications. Cont. to Mineral. and Petrog., pp. 287-290, 1901. (From Am. Jour. Sci., vol. 4, pp. 313-316, 1897.)

598 — and **Foote** (H. W.). On *bixbyite*, a new mineral.
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599 — — — On *clinochedrite*, a new mineral from Franklin, N. J.
Yale Bicentennial publications. Cont. to Mineral. and Petrog., pp. 291-296, 1901. (From Am. Jour. Sci., vol. 5, pp. 289-293, 1898.)

600 — and **Ford** (W. E.). On *calaverite*.
Am. Jour. Sci., 4th ser., vol. 12, pp. 225-245, figs. 1-30, 1901.
Describes occurrence and crystallographic characters of the material.

601 — and **Pirsson** (L. V.). Contributions to mineralogy and petrography, from the laboratories of the Sheffield Scientific School of Yale University.
Yale Bicentennial publications. August, 1901, 482 pp., Charles Scribner's Sons, New York.
Abstracts: Am. Geol., vol. 28, pp. 322-323, 1901. Am. Jour. Sci., 4th ser., vol. 12, pp. 398 ($\frac{1}{2}$ p.), 1901.

602 — and **Pratt** (J. H.). On the occurrence of *thaumasite* at West Paterson, New Jersey.
Yale Bicentennial publications. Cont. to Mineral. and Petrog., pp. 246-251, 1901. (From Am. Jour. Sci., vol. 1, pp. 229-233, 1896.)

603 — and **Warren** (C. H.). Some new minerals from the zinc mines at Franklin, N. J., and note concerning the chemical composition of *ganomalite*.
Yale Bicentennial publications. Cont. to Mineral. and Petrog., pp. 325-342, 1901. (From Am. Jour. Sci., vol. 8, pp. 339-353, 1899.)

604 **Penhallow** (D. P.). Notes on the North American species of *Dadoxylon*, with special reference to type material in the collections of the Peter Redpath Museum, McGill College
Can. Roy. Soc., Proc. & Trans., 2nd ser., vol. 6, sect. 4, pp. 51-97,
figs. 1-18, 1900.

605 —— **A** decade of North American Paleobotany, 1890-1900.
Science, new ser., vol. 13, pp. 161-176, 1901.
Presidential address before the Society of Plant Morphology and Physiology.

606 —— [Review of "Studies in fossil botany," by D. H. Scott.]
Science, new ser., vol. 13, pp. 386-389, 1901.

607 —— [Review of "The Mesozoic flora of the United States," by L. F. Ward et al.]
Science, new ser., vol. 13, pp. 904-906, 1901.

608 **Phillips** (William Battle). Texas petroleum.
Texas Univ. Min. Surv., Bull. No. 1, pp. 1-102, 1901.
Describes the nature and origin of petroleum and the oil and gas-bearing horizons of Texas.

609 —— The Beaumont oil field, Texas.
Eng. & Mg. Jour., vol. 71, pp. 175-176, 1901.
Contains notes on the geology of the region.

610 —— The zinc-lead deposits of southwest Arkansas.
Eng. and Mg. Jour., vol. 71, pp. 431-432, 1901.
Contains brief notes on the character and occurrence of the ore

611 —— The bat guano caves of Texas.
Mines and Minerals, vol. 21, pp. 440-442, 6 figs., 1901.
Describes occurrence and chemical character of the material.

612 **Pierce** (S. J.). The Cleveland water-supply tunnel [Ohio].
Am. Geol., vol. 28, pp. 380-385, 1901.
Describes the quicksands and clays and other material penetrated in driving this tunnel.

613 **Pilsbry** (Henry A.). Crustacea of the Cretaceous formation of New Jersey.
Phil. Acad. Nat. Sci., Proc., 1901, pp. 111-118, pl. 1, 1901.

614 **Pirsson** (Louis V.). [Review of "Geological and Natural History of Minnesota, Vol. V;" and "Étude minéralogique et petrographique des Roches gabbroïques de l'État de Minnesota, États-Unis, et plus spécialement des Anorthosites," by A. N. Winchell.]
Am. Jour. Sci., 4th ser., vol. 11, pp. 88-89, 1901.

615 **Pirsson** (Louis V.). On mordenite.

Yale Bicentennial publications. Cont. to Mineral. and Petrog., pp. 176-182, 1901. (from Am. Jour. Sci., vol. 40, pp. 232-237, 1890)

616 — On the petrography of Square Butte in the Highwood Mountains of Montana.

Yale Bicentennial publications. Cont. to Mineral. and Petrog., pp. 415-435, 1901. (from Geol. Soc. Am., Bull., vol. 6, pp. 389-422, 1895)

617 — Petrography of the rocks of Yogo Peak [Montana].

Yale Bicentennial publications. Cont. to Mineral. and Petrog., pp. 436-456, 1901. (abstract from U. S. Geol. Surv., 20th Ann. Rept., pt. 111, pp. 471-488, 1900)

617a — **Penfield** (Samuel L.) and. Contributions to mineralogy and petrography, from the laboratories of the Sheffield Scientific School of Yale University.

See Penfield (S. L.) and Pirsson (L. V.), 601.

618 — **Weed** (Walter H.) and. Missourite, a new leucite rock from the Highwood Mountains of Montana.

See Weed (Walter H.) and Pirsson (Louis V.), 799.

619 — — Geology of the Shonkin sag and Palisade Butte laccoliths in the Highwood Mountains of Montana.

See Weed (W. H.) and Pirsson (L. V.), 798.

620 **Pompecky** (J. F.). Jura-fossilien aus Alaska.

Verhandl. Kais. Russ., Mineralog. Gesell., St. Petersbourg, ser. 2, Band. 38, No. 1, 1900. (Not seen.)

Abstract: Am. Nat., vol. 35, pp. 420-421, 1901.

621 **Pratt** (Joseph Hyde). A peculiar iron of supposed meteoric origin from Davidson County, North Carolina.

Elisha Mitchell Sci. Soc., Jour., 17th year, pt. 2, pp. 21-26, 1901. Describes character of the material and gives chemical analysis.

622 — The occurrence and distribution of corundum in the United States.

U. S. Geol. Surv., Bull. No. 180, pp. 1-98, pls. i-xiv, figs. 1-14, 1901. Describes the modes of occurrence and distribution of corundum and the corundum localities in the United States.

623 — On northupite; pirssonite, a new mineral; gay-lussite and hanksite from Borax Lake, San Bernardino County, California.

Yale Bicentennial publications. Cont. to Mineral. and Petrog., pp. 261-274, 1901. (from Am. Jour. Sci., vol. 2, pp. 128-135, 1896)

624 — and **Foote** (H. W.). On wellsite, a new material.

Yale Bicentennial publications. Cont. to Mineral. and Petrog., pp. 275-282, 1901. (from Am. Jour. Sci., vol. 3, pp. 443-448, 1897)

625 **Pratt** (Joseph Hyde) and **Penfield** (S. L.). On the occurrence of thaumasite at West Paterson, New Jersey.
See Penfield (S. L.) and Pratt (J. H.), 602.

626 **Preston** (C. H.). Prof. W. H. Barris.
Am. Geol., vol. 28, pp. 358-361, pl. 33, 1901.
Gives a sketch of his life and work on the paleontology of Iowa.

627 **Price** (J. A.) and **Shaaf** (Albert). Spy Run and Poinsett lake bottoms [Indiana].
Ind. Acad. Sci., Proc. for 1900, pp. 179-181, 1901.
Describes glacial phenomena.

628 — — — Abandoned meanders of Spy Run Creek [Indiana].
Ind. Acad. Sci., Proc. for 1900, pp. 181-184, 1 fig., 1901.
Describes its drainage modifications.

629 **Prosser** (Charles S.). The classification of the Waverly series of Central Ohio.
Jour. Geol., vol. 9, pp. 205-231, figs. 1-4, 1901.
Reviews the various classifications of this series that have been published, describes the character and occurrence of the strata, and gives the author's classification.

630 — [On the use of the term Bedford limestone.]
Jour. Geol., vol. 9, pp. 270-272, 1901.
Reviews an article by C. E. Siebenthal on the same subject and considers the name Bedford as applied in Ohio should be accepted.

631 — The Paleozoic formations of Allegany County, Maryland.
Jour. Geol., vol. 9, pp. 409-429, figs. 1-4, 1901.
Describes the character and occurrence of the various Paleozoic formations and discusses their probable correlations with New York and Pennsylvanian formations.

632 — Names for the formations of the Ohio Coal Measures.
Am. Jour. Sci., 4th ser., vol. 11, pp. 191-199, 1901.
Reviews previous classification and nomenclature of the Coal Measures of Pennsylvania and West Virginia and presents a section and the classification of the Coal Measures of Maryland, which has been adopted for the Ohio Coal Measures.

633 **Purdue** (A. H.). Valleys of solution in northern Arkansas.
Jour. Geol., vol. 9, pp. 47-50, figs. 1-2, 1901.
Describes the character and occurrence of these valleys and discusses their origin.

634 — Illustrated note on a miniature overthrust fault and anticline.
Jour. Geol., vol. 9, pp. 341-342, 1 fig., 1901.
Describes a miniature anticline passing into a reversed fault at Ozark, Ark.

635 — Physiography of the Boston Mountains, Arkansas.
Jour. Geol., vol. 9, pp. 694-701, figs. 1-2, 1901.
Abstract: Sci. Am. Suppl., vol. 52, p. 21505, 1901.
Describes the structural and topographic features of the region.

636 **Purington** (Chester Wells). Economic geology. *La Plata Folio, Colo.*

U. S. Geol. Surv., Geol. Atlas of U. S., Folio No. 60, 1899.

Describes the vein systems, the occurrence of gold and silver ores, the placer deposits, and the occurrence of coal.

Q.

637 **Queneau** (A. J.). The grain of igneous rocks.

Abstract: N. Y. Acad. Sci., Annals, vol. 14, p. 163, 1901.

R.

638 **Randolph** (Beverley S.). [In discussion of paper by Charles Catletton, "Coal outcrops."]

Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 1005-1006, 1901.

639 **Ransome** (Frederick Leslie). A report on the economic geology of the Silverton quadrangle, Colorado.

U. S. Geol. Surv., Bull. No. 182, pp. 1-265, pls. i-xvi, figs. 1-23, 1901.

Describes the lode fissures, the characters of the ores and of the stocks or masses, and the origin of the ore deposits. Includes detailed descriptions of special areas.

640 — A peculiar clastic dike near Ouray, Colorado, and its associated deposit of silver ore.

Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 227-236, figs. 1-2, 1901.

Describes the occurrence, character, and origin of the dike and of the associated ore body.

641 **Raymond** (R. W.). Recent contributions to the science of ore deposits.

Min. Ind. for 1900, pp. 753-762, 1901.

Gives a review and summaries of recent important papers on the origin of ore deposits.

642 **Reid** (Harry Fielding). *De la progression des glaciers, leur stratification, et leurs veines bleues.*

Int. Cong. Geol., Compte Rendu, viii session, pp. 749-755, 1901.

643 — The variations of glaciers, VI.

Jour. Geol., vol. 9, pp. 250-254, 1901.

This paper comprises a summary of the Fifth Annual report of the International Committee on glaciers.

644 — [Review of "Les variations de Longueur des Glaciers dans les Regions Artique et Boriales," by Charles Rabot.]

Science, new ser., vol. 14, pp. 928-930, 1901.

645 **Richards** (Joseph W.). "Mohawkite."

Am. Jour. Sci., 4th ser., vol. 11, pp. 457-458, 1901.

Abstract: Am. Geol., vol. 28, pp. 58 (10-11), 1901.

Gives results of the author's chemical studies, which prove the existence of the species termed mohawkite and of another species for which the name ledouxite is proposed.

646 **Rickard** (Forbes). Notes on Nome, and the outlook for vein mining in that district [Alaska].

Eng. and Mg. Jour., vol. 71, pp. 275-276, 1 fig., 1901.

Contains notes on the geology of the region and the occurrence of gold.

647 **Rickard** (T. A.). The Cripple Creek volcano [Colorado].

Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 367-403, figs. 1-2, 1901.

Gives an account of the various stages of eruption in this volcano and compares it with volcanos in other regions.

648 — The telluride ores of Cripple Creek [Colorado] and Kalgoorlie [Australia].

Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 708-718, 1901.

Describes the characteristics of the ores of these regions.

649 **Ries** (Heinrich). Theodore Greely White.

Am. Geol., vol. 28, pp. 269-270, with portrait, 1901.

Gives a brief sketch of his life and work, and a list of publications.

650 **Riggs** (Elmer S.). The Dinosaur beds of the Grand River valley of Colorado.

Field Col. Mus., Geol. ser., vol. 1, pp. 267-274, pls. 34-39, 1901.

Describes the general character of the Cretaceous, Jurassic, and Triassic strata and the occurrence of vertebrate remains.

651 — The fore leg and pectoral girdle of Morosaurus. With a note on the genus Camarosaurus.

Field Col. Mus., Geol. ser., vol. 1, pp. 275-281, pls. 40-42, 1901.

652 — The largest known dinosaur.

Science, new ser., vol. 13, pp. 549-550, 1901.

Contains brief description of the skeleton obtained by a recent expedition of the Field Columbian Museum.

653 **Ritter** (Wm. E.). Some observations bearing on the probable subsidence during recent geologic times of the Island of Santa Catalina off the coast of southern California.

Science, new ser., vol. 14, pp. 575-577, 1901.

654 **Robinson** (H. H.). On octohedrite and brookite, from Brindletown, North Carolina.

Am. Jour. Sci., 4th ser., vol. 12, pp. 180-184, figs. 1-6, 1901.

Describes occurrence and crystallographic characters of the minerals.

655 **Rogers** (Austin F.). Mineralogical notes, No. 2.

Am. Jour. Sci., 4th ser., vol. 12, pp. 42-48, figs. 1-8, 1901.

Describes crystallographic characters of calcite, galena, pyrite, topaz, leadhillite, iivarite, caledonite, barite, and celestite.

656 — The Pottawatomie and Douglas formations along the Kansas River.

Kan. Univ. Quart., vol. 9, pp. 234-254, 1900.

Gives lists of fossils from various localities.

657 **Ropes** (Leverett S.). [Corundum of North Carolina.]
 Min. Ind., 1899, pp. 12-14, 1900.
 Notes on occurrence.

658 **Rowley** (R. R.). Two new genera and some new species of fossils from the Upper Paleozoic rocks of Missouri.
 Am. Geol., vol. 27, pp. 343-355, pl. 28, 1901.
 Describes species of two little known groups of blastoids.

659 **Ruedemann** (Rudolf). Hudson River beds near Albany and their taxonomic equivalents.
 N. Y. State Mus., Bull. No. 42, pp. 489-587, pls. 1-2, figs. 1-5, 1901.
 Abstract: Am. Geol., vol. 27, pp. 377-378, 1901.
 Reviews previous work on these strata. Describes the lithologic and faunal characters at various localities in the region and discusses the geologic structure and correlation of the beds. Describes the characters of new species of fossils collected.

660 — Trenton conglomerate of Rysedorph Hill, Rensselaer County, N. Y., and its fauna.
 N. Y. State Mus., Bull. 49, pp. 3-114, pls. A-B and 1-7, 1901.
 Describes the stratigraphic relations and characters of the fauna.

661 **Russell** (Israel C.). Geology and water resources of Nez Perce County, Idaho. Part I.
 U. S. Geol. Surv., Water-Supply and Irrigation Papers, No. 53, pp. 1-85, pls. i-x, figs. 1-4, 1901. Abstract: Am. Geol., vol. 28, pp. 319-321, 1901.
 Describes the pre-Tertiary terranes, the Columbia lava, the soils and the physiography of the region.

662 — Geology and water resources of Nez Perce County, Idaho. Part II.
 U. S. Geol. Surv., Water-Supply and Irrigation Papers, No. 54, pp. 95-141, figs. 5-14, 1901.
 Describes the character and occurrence of the water supply, building stones, and lignite. Includes a bibliography of artesian waters and a note concerning Portland cement.

663 **Rutland** (Joshua). Mammals and reptiles; or what was the Ice ages?
 Sci. Am. Suppl., vol. 51, pp. 21032-21033, 1901.
 Describes their occurrence and characters in geologic times.

664 **Rutley** (Frank). Mineralogy.
 12th ed., 240 pp., 1900. Thomas Murby, London.
 Review: Am. Jour. Sci., 4th ser., vol. 11, p. 921 (3 p.), 1901.

S.

665 **Safford** (J. M.). Classification of the geological formations of Tennessee.
 Geol. Soc. Am., Bull., vol. 13, pp. 10-14, 1901.
 Gives in tabular form a list of the geological formations of Tennessee and includes brief notes regarding them.

666 **Safford** (J. M.). Horizons of phosphate rocks in Tennessee.
Geol. Soc. Am., Bull., vol. 13, pp. 14-15, 1901.
Describes the geologic relations of the various phosphate deposits.

667 **Salisbury** (Rollin D.) [Reviews of "The Norwegian Polar Expedition, 1893 to 1896. Scientific Results, Vol. I," and "The Pleistocene geology of the South Central Sierra Nevada, with especial reference to the origin of the Yosemite Valley," by H. W. Turner.]
Jour. Geol., vol. 9, pp. 87-91, 1901.

668 — [Reviews of "Handbuch der Seenkunde, allgemeine Limnologie," by F. A. Forel: "A preliminary report on the Artesian basins of Wyoming," by Wilbur C. Knight; and "Die vierte Eiszeit im Bereich der Alpen," by Albrecht Penck.]
Jour. Geol., vol. 9, pp. 199-202, 1901.

669 — [Review of "Glacial sculpture of the Bighorn Mountains, Wyoming," by F. E. Matthes.]
Jour. Geol., vol. 9, pp. 465-466, 1901.

670 — Glacial work in the Western mountains in 1901.
Jour. Geol., vol. 9, pp. 718-731, 1901.
Describes the results of the work of several parties of students in various parts of western United States.

671 **Sardeson** (Frederick W.). Problem of the Monticuliporoidea. I.
Jour. Geol., vol. 9, pp. 1-27, pl. A. and fig. 1, 1901.
Describes the characters of various species of Trepostomata and discusses their affinities.

672 — Problem of the Monticuliporoidea. II.
Jour. Geol., vol. 9, pp. 149-173, pl. B, fig. 2, 1901.
Describes the general characters of various species of Cryptostomata and discusses their affinities.

673 — Note on the western Tertiary.
Science, new ser., vol. 13, pp. 868-869, 1901.
Contains notes on the occurrence of fossils as indicating the mode of formation of the strata.

674 — Fossils in the St. Peter sandstone.
Minn. Acad. Nat. Sci., Bull., vol. 3, pp. 318-319, 1901.

675 — Paleozoic fossils in the drift [Minnesota].
Minn. Acad. Nat. Sci., Bull., vol. 3, pp. 317-318, 1901.

676 — The lower Silurian formations of Wisconsin and Minnesota compared.
Minn. Acad. Nat. Sci., Bull., vol. 3, pp. 319-326, fig. 8, 1901.

677 **Sardeson** (Frederick W.). The range and distribution of the lower Silurian fauna of Minnesota, with descriptions of some new species.
Minn. Acad. Nat. Sci., Bull., vol. 3, pp. 326-343, 1901.

678 **Sarle** (Clifton J.). Reef structures in Clinton and Niagara strata of western New York.
Am. Geol., vol. 28, pp. 282-299, pls. 27-31, 1901.
Describes occurrence of irregular, hardened masses in the limestone and discusses their origin. Describes similar occurrences in other geologic horizons.

679 **Schiottz** (O. E.). Results of the pendulum observations and some remarks on the constitution of the earth's crust.
Nansen's Norwegian North Polar expedition. Scientific results, vol. 2, viii, pp. 1-90, 1901.

680 **Scholz** (C.). [In discussion of paper by Charles Catlett on "Coal outcrops."]
Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 1107-1109, 1901.

681 **Schrader** (F. C.) and **Brooks** (Alfred H.). Some notes on the Nome gold region of Alaska.
Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 236-247, figs. 1-3, 1901.
Describes the topography of the region, the occurrence of the placers, and the origin of the beach placers.

682 **Schuchert** (Charles). On the Helderbergian fossils near Montreal, Canada.
Am. Geol., vol. 27, pp. 245-253, figs. A-D, 1901.
Contains notes on the fossils and probable correlations of the St. Helens island faunas of New York. Figures two new species.

683 **Scott** (Dunkinfield Henry). Studies on fossil botany.
The Macmillan Co., N. Y., 533 pp., 1900.
Abstract: Am. Nat., vol. 35, pp. 73-77, 1901.

684 **Scott** (W. B.). Historical geology.
Sci. Am. Suppl., vol. 52, pp. 21352-21353, 1901.
Abstract of lecture delivered at the Wagner Institute, Philadelphia, Pa.

685 —— Earth carrying.
Sci. Am. Suppl., vol. 52, p. 21456, 1901.
Abstract of lecture delivered at the Wagner Institute, Philadelphia, Pa.

686 **Seeley** (Henry M.). Sketch of the life and work of Augustus Wing.
Am. Geol., vol. 28, pp. 1-8, pl. 1, 1901.
Describes the life of Augustus Wing and his work on the geology of Vermont.

687 **Seeley** (Henry M.). The geology of Vermont.

The Vermonter, vol. 5, pp. 53-67, Feb., 1901. (Not seen.)

688 **Sellards** (E. H.). Permian plants. *Taeniopteris* of the Permian of Kansas.

Kan. Univ. Quart., vol. 10, pp. 1-12, pls. 1-4, 1901.

689 —— Fossil plants in the Permian of Kansas.

Kan. Acad. Sci., Trans., vol. 17, pp. 208-209, 1901.

Describes occurrence of the plant remains at various localities.

690 **Shaaf** (Albert), **Price** (J. A.) and. Spy Run and Poinsett lake bottoms.

See Price (J. A.) and Shaaf (A.), 627.

691 —— Abandoned meanders of Spy Run Creek [Indiana].

See Price (J. A.) and Shaaf (A.), 628.

692 **Shaler** (N. S.). Broad valleys of the Cordilleras.

Geol. Soc. Am., Bull., vol. 12, pp. 271-300, 1901.

Discusses the origin and development of these valleys and the bearing of the evidence on the orographic features of the region.

693 **Shattuck** (George Burbank). The Pleistocene problem of the North Atlantic Coastal plain.

John Hopkins Univ., Circular No. 152, pp. 69-75, 1901.

Am. Geol., vol. 28, pp. 87-107, 1901.

Reviews the opinions of various writers on these problems and gives the author's conclusions.

694 —— Apparent unconformities during periods of continuous sedimentation.

Abstract: Science, new ser., vol. 13, pp. 99-100, 1901.

695 **Sheldon** (J. M. Arms). Concretions from the Champlain clays of the Connecticut valley.

45 pp., 1900. (Not seen.) Boston, Mass.

Abstract: Am. Jour. Sci., 4th ser., vol. 11, p. 397 (1 p.), 1901.

696 **Shimek** (B.). Recent decline in the level of Lake Nicaragua.

Am. Geol., vol. 28, pp. 396-398, 1901.

Refers to a paper published in 1896 on the same subject.

697 —— The loess of Iowa City and vicinity [Iowa].

Iowa State Univ., Lab. Nat. Hist., Bull., vol. 5, pp. 195-212, 1901.

Am. Geol., vol. 28, pp. 344-358, 1901.

Gives list of loess and recent fossils with notes on some of the species.

698 **Siebenthal** (C. E.). On the use of the term Bedford limestone.

Jour. Geol., vol. 9, pp. 234-235, 1901.

Discusses the use of the name in Ohio and Indiana and considers the Bedford of Indiana has priority.

699 **Siebenthal** (C. E.). [Review of "Twenty-fifth Annual Report, Department of Geology and Natural Resources of Indiana."] *Jour. Geol.*, vol. 9, pp. 354-356, 1901.

700 —— [Review of "Texas petroleum" by William Battle Phillips.] *Jour. Geol.*, vol. 9, pp. 637-638, 1901.

701 —— The Silver Creek hydraulic limestone of southeastern Indiana.
Ind. Dept. of Geol. and Nat. Res., 25th Ann. Rept., pp. 331-389, pls. 13-14, figs. 71-72, 1901.
Reviews the geologic literature regarding the region, describes the stratigraphic and paleontologic features and nomenclature of the Devonian formations, and gives an account of the economic uses of the limestone.

702 **Simonds** (Frederic W.). The minerals and mineral localities of Texas.
Abstract: *Science*, new ser., vol. 14, p. 797, 1901.
Gives an account of the preparation of a list of Texas minerals and localities.

703 **Sinclair** (William J.). The discovery of a new fossil tapir in Oregon.
Jour. Geol., vol. 9, pp. 702-707, fig. 1, 1901.
Describes *Protapirus robustus* n. sp. from the John Day beds.

704 **Slosson** (E. E.), **Knight** (W. C.) and. Alkali lakes and deposits [Wyoming].
See Knight (W. C.) and Slosson (E. E.), 451.

705 —— The Dutton, Rattlesnake, Arago, Oil Mountain, and Powder River oil fields [Wyoming].
See Knight (W. C.) and Slosson (E. E.), 450.

706 **Smith** (Alva J.). The *Americus* limestone.
Kans. Acad. Sci., Trans., vol. 17, pp. 189-190, pls. 15-17, 1901.
Describes its distribution in Lyon County, Kansas, and its petrographic and faunal characters.

707 **Smith** (George Otis). A geological study of the Fox Islands, Maine.
Colby College, Bull., vol. 1, supplement, pp. 1-53, and geologic map, 1901.
Describes the character and occurrence of the sedimentary and igneous rocks and the geologic history of the islands.

708 —— Geology and water resources of a portion of Yakima County, Washington.
U. S. Geol. Surv., Water Supply and Irrigation Papers, No. 55, pp. 1-68, pls. i-vii, figs. 1-8, 1901.
Describes the geographic and geologic features of the region and the water resources.

709 **Smith** (George Otis) and **Willis** (Bailey). The Clealum iron ores, Washington.

Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 356-366, 1 fig., 1901.

Describes the character, occurrence and origin of the ores and the general geologic and structural feature of the region.

710 **Smith** (James Perrin). The border line between the Paleozoic and Mesozoic in western America.

Jour. Geol., vol. 9, pp. 512-521, 1901.

Discusses briefly the criteria by which geologic time divisions of the line between this Paleozoic and Mesozoic as influenced by the faunas of certain beds of Idaho and California and their relation to allied Asiatic and European faunas.

711 — and **Weller** (Stuart). Prodromites, a new ammonite genus from the Lower Carboniferous.

Jour. Geol., vol. 9, pp. 255-268, pls. 6-8, 1901.

Discusses the occurrence of ammonites in upper Paleozoic rocks of the Mississippi Valley, and describes a new genus and two new species.

712 **Smock** (John C.). Administrative report. (New Jersey Geological Survey.)

N. J. Geol. Surv., Ann. Rept. for 1900, pp. xi-xl, 1901.

Gives an account of the work of the Survey for the year, and discusses the character and relations of the surface formations of southern New Jersey.

713 **Smyth** (C. H., jr.). Geology of the crystalline rocks in the vicinity of the St. Lawrence River.

N. Y. State Mus., 53d Ann. Rept., vol. 1, pp. r85-r104, pls. 13-24 and geologic map, 1901.

Describes the gneiss and associated rocks of the region.

714 **Sollas** (W. J.). Evolutional geology.

Smith. Inst., Ann. Rept. 1900, pp. 289-314, pl. 1, 1901.

715 **Spalding** (E. P.). The quicksilver mines of Brewster County, Texas.

Eng. & Mg. Jour., vol. 71, pp. 749-750, figs. 1-6, 1901.

Contains notes on the character and occurrence of the ore.

716 **Spencer** (Arthur C.). The iron ores of Santiago, Cuba.

Eng. & Mg. Jour., vol. 72, pp. 633-634, 6 figs., 1901.

Describes the character and geologic relations of the ore bodies.

717 — The physiography of the Copper River basin, Alaska.

Abstract: Science, new ser., vol. 13, p. 189, 1901.

Contains abstract of paper read before the Geological Society of Washington.

718 — See **Cross** (Whitman), 176.

719 **Spencer** (Joseph William Winthrop). On the geological and physical development of Antigua.

London Geol. Soc., Quart. Jour., vol. 57, pp. 490-505, and map, 1901.

720 **Spencer** (Joseph William Winthrop). On the geological and physical development of Guadelupe.
 London Geol. Soc., Quart. Jour., vol. 57, pp. 506-519, 1901.

721 — On the geological and physical development of Anguilla, St. Martin, St. Bartholomew, and Sombrero.
 London Geol. Soc., Quart. Jour., vol. 57, pp. 520-533, 1901.

722 — On the geological and physical development of the St. Christopher chain and Saba Banks.
 London Geol. Soc., Quart. Jour., vol. 57, pp. 534-544, 1901.

723 **Spurr** (Josiah Edward). Origin and structure of the Basin ranges.
 Geol. Soc. Am., Bull., vol. 12, pp. 217-270, pls. 20-25, 1901.
 Abstract: Science, new ser., vol. 13, p. 98, 1901.
 Describes the structural features of the ranges in the Great Basin region and discusses their origin.

724 — Variations of texture in certain Tertiary igneous rocks of the Great Basin.
 Jour. Geol., vol. 9, pp. 586-606, fig. 1, 1091.
 Describes the character and occurrence of the variations of certain andesitic and rhyolitic rocks and gives chemical analyses.

725 **Stanton** (Timothy W.). [Report on Cretaceous fossils from the John Day Basin, Oregon.]
 Univ. of Cal., Dept. of Geol., Bull., vol. 2, pp. 280-284, 1901.
 Gives list of fossils with notes on some of the species and discusses the faunal relations.

726 — Chondrodonta, a new genus of ostreiform mollusks from the Cretaceous, with descriptions of the genotype and a new species.
 U. S. Nat. Mus., Proc., vol. 24, pp. 301-307, pls. 25-26, 1901.

727 **Stearns** (Robert E. C.). Fossil land shells of the John Day region, with notes on related living species.
 Wash. Acad. Sci., Proc., vol. 2, pp. 651-658, pl. 35, 1900.

727a — The fossil fresh-water shells of the Colorado desert, their distribution, environment, and variation.
 U. S. Nat. Mus., Proc., vol. 24, pp. 271-299, pls. xix, xxiv, 1901.

728 **Stevens** (E. A.). An occurrence of limburgite in the Cripple Creek district [Colorado].
 Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 759-764, figs. 1-4, 1901.
 Describes the occurrence and character of this rock type.

729 **Stokes** (H. N.). On pyrite and marcasite.
 U. S. Geol. Surv., Bull. No. 186, pp. 1-50, pl. 1, figs. 1-2, 1901; Am. Jour. Sci., 4th ser., vol. 12, pp. 414-420, 1901.
 Describes the uncertainty of the methods of distinguishing pyrite and marcasite and a method for the quantitative determination of the minerals when in mixture, and discusses the relations of these sulphides to those of copper.

730 **Stokes** (N. H.), **Merrill** (George P.) and. A new stony meteorite from Allegan, Michigan, and a new iron meteorite from Mart, Texas.

See Merrill (George P.) and Stokes (H. N.), 546.

731 **Stose** (George W.). [Review of "Allegany County, Maryland."]
Science, new ser., vol. 14, pp. 181-182, 1901.

732 **Stone** (George H.). Note on the minerals associated with copper in parts of Arizona and New Mexico.

Abstracts: Science, new ser., vol. 14, pp. 796-797, 1901.
Sci. Am. Suppl., vol. 52, p. 21505, 1901.

733 — Note on the extinct glaciers of New Mexico and Arizona.

Abstract: Science, new ser., vol. 14, p. 798, 1901.
Brief account of occurrence.

734 **Stretch** (R. H.). The Silverton mining district, Snohomish County, Washington.

Eng. and Mg. Jour., vol. 72, p. 105, 1901.
Describes briefly the occurrence of copper ores.

T.

735 **Taff** (Joseph A.). A comparison of the Ouachita and Arbuckle Mountain sections, Indian Territory.

Abstract: Science, new ser., vol. 13, pp. 271-272, 1901.
Briefly describes sections of Paleozoic rocks.

736 — Colgate Folio—Indian Territory.

U. S. Geol. Surv., Geol. Atlas of U. S., Folio No. 74, 1901.
Describes the geographic and topographic features, the general geologic relations, the character and occurrence of the Carboniferous, Neocene and Pleistocene strata, and the occurrence of coal.

737 **Talmage** (J. E.). A recent fault slip, Ogden Canyon, Utah.

Science, new ser., vol. 13, p. 550, 1901.
Gives a brief account of the phenomena.

738 **Taylor** (F. B.). Glacial phenomena in eastern Ontario.

Abstract: Science, new ser., vol. 13, p. 138, 1901.

739 **Tays** (E. A. H.). Genesis of ore deposits.

Mg. and Sci. Press., vol. 83, pp. 142-143, 3 figs., 1901.
Discusses article by M. W. Alderson on the same subject.

740 **Tight** (W. G.). Pre-Glacial drainage in southwestern Ohio.

Science, new ser., vol. 14, pp. 775-776, 1901.
Discusses recent article by A. M. Miller on the same subject.

741 **Todd** (James E.). River action phenomena.

Geol. Soc. Am., Bull., vol. 12, pp. 486-490, 1901.

Discusses the variations in phenomena of river action in time of flood and the formation of silt and loess deposits.

742 **Todd** (James E.). Some problems of the Dakota artesian system.

Abstract: *Science*, new ser., vol. 14, p. 794, 1901.

Sci. Am. Suppl., vol. 52, p. 21504, 1901.

743 —— Moraines and maximum diurnal temperature.

Abstracts: *Science*, new ser., vol. 14, pp. 794-795, 1901.

Sci. Am. Suppl., vol. 52, p. 21504, 1901.

Describes certain glacial phenomena.

744 **Turner** (Henry W.). The geology of the Great Basin in eastern California and southwestern Nevada.

Abstracts: *Jour. Geol.*, vol. 9, p. 73 ($\frac{1}{2}$ p.), 1901; *Geol. Soc. Am., Bull.*, vol. 12, p. 498 ($\frac{1}{2}$ p.), 1901.

Describes the structure of the region and its general stratigraphic features.

745 —— Perknite (lime-magnesia rocks).

Jour. Geol., vol. 9, pp. 507-511, 1901.

Describes the character and occurrence of a new rock type and gives chemical analyses of rocks included in this group.

746 —— The mines of Esmeralda County, Nevada.

Mg. and Sci. Press, vol. 82, pp. 73-74, 1901.

Contains notes on the general geology of portions of the County.

747 **Tyrrell** (J. B.). Report on the east shore of Lake Winnipeg and adjacent parts of Manitoba and Keewatin, compiled by D. B. Dowling.

Can. Geol. Surv., new ser., vol. 11, *Rept. G.*, 96 pp., 3 pls., 1901, published in 1900.

Describes the physiography and drainage of the region and the character of the crystalline rocks.

U.

748 **Udden** (J. A.). Geology of Louisa County [Iowa].

Iowa Geol. Surv., vol. 11, pp. 58-126, pl. 4, fig. 1, 2 maps, 1901.

Describes the physiography, the character and distribution of the Carboniferous and Pleistocene deposits and the occurrence of economic products.

749 —— Geologie of Pottawattamie County [Iowa].

Iowa Geol. Surv., vol. 11, pp. 202-277, pl. 6, figs. 13-15 and map, 1901.

Describes the physiography, the character and occurrence of the Carboniferous, Cretaceous, and Pleistocene strata and the occurrence of economic products.

750 **Ulrich** (E. O.). Systematic paleontology, Eocene Arthropoda.

Md. Geol. Surv., Eocene, pp. 116-122, pl. 16, 1901.

751 —— Eocene Molluscoidea (Bryozoa).

Md. Geol. Surv., Eocene, pp. 205-222, pls. 59-60, 1901.

752 **Upham** (Warren). Artesian wells in North and South Dakota.
Minn. Acad. Nat. Sci., Bull., vol. 3, pp. 370-379, 1901.

753 — Pre-Glacial erosion in the course of the Niagara gorge, and its relation to estimates of post-Glacial time.
Am. Geol., vol. 28, pp. 235-244, 1901.
Gives the author's views of the glacial history of the region and discusses their bearing on estimates of post-Glacial time.

754 — The antiquity of the races of mankind.
Am. Geol., vol. 28, pp. 250-254, 1901.
Reviews the evidences indicating the pre-Glacial origin of man.

755 — [Review of "Iowa Geological Survey, volume 11."]
Am. Geol., vol. 28, p. 258, (½ p.), 1901.

756 — The Toronto and Scarboro drift series [Ontario].
Am. Geol., vol. 28, pp. 306-316, 1901.
Quotes Coleman's description of these beds and discusses the bearing of the evidences on the existence of interglacial epochs of moderate oscillations of the ice border.

757 — [Review of "Geological Survey of Canada, Annual Report, new series, volume 11, 1898."]
Am. Geol., vol. 28, pp. 321-322, 1901.

V.

758 **Van Hise** (Charles R.). Some principles controlling the deposition of ores.

Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 27-177, figs. 1-10, 1901.
Abstracts: Am. Jour. Sci., 4th ser., vol. 11, p. 90 (½ p.), 1901; Eng. & Mg. Jour., vol. 72, pp. 699-702, 1901.

This subject is discussed under the following general heads: Three zones of the lithosphere; the water content and openings in rocks; physico-chemical principles controlling the work of underground waters; general geologic work of underground waters; the precipitation of ores by ascending waters; precipitation of ores by ascending and descending waters combined; the association of certain ores; concentration; enrichment and diminution of richness in depth; special factors affecting the concentration of ores, and the classification of ore deposits.

759 — The iron-ore deposits of the Lake Superior region.
U. S. Geol. Surv., 21st Ann. Rept., Pt. III, pp. 305-434, pls. xlvi-lix, 1901.
Describes the general stratigraphy and occurrence of iron ores in the several districts of the Lake Superior region. The Mesabi district is by C. R. Van Hise and C. K. Leith. The Vermillion iron-bearing district is by C. R. Van Hise and J. Morgan Clements.

760 — The geology of ore deposits.
Science, new ser., vol. 14, pp. 745-757, figs. 1-6, 785-793, 1901.
Abstract: Sci. Am. Suppl., vol. 52, p. 21504, 1901.
Discusses the evidences that metallic ores and gangue are deposited by underground waters.

761 **Van Hise** (Charles R.). [Discussion of "Ice ramparts," by E. R. Buckley].

Wis. Acad. Sci. Arts and Letters, Trans., vol. 13, Pt. I, pp. 158-162, pls. 14-18, 1901.

Compares the phenomena of ice deformation with those of crustal deformation.

762 **Van Ingen** (Gilbert). The Siluric fauna near Batesville, Arkansas, I.

School of Mines Quart., vol. 22, pp. 318-328, fig. 1, 1901.

Describes the geologic relations of the strata. Includes a bibliography.

763 — The Siluric fauna near Batesville, Arkansas.

School of Mines Quart., vol. 23, pp. 34-74, figs. 9-22, 1901.

Describes the characters of the various species collected.

764 — [Paleozoic rocks of northwestern New Jersey.]

Abstract: Am. Geol., vol. 27, pp. 42-43, 1901.

Contains considerable data on the Paleozoic strata and faunas of New Jersey.

765 **Vaughan** (T. Wayland). Eocene Coelenterata.

Md. Geol. Surv., Eocene, pp. 222-232, pl. 61, 1901.

766 — Some fossil corals from the elevated reefs of Curaçao, Aruba, and Bonaire.

Sammlungen d. Geol. Reichs-Museum, Leiden, ser. 11, Bd. 11, Heft 1, 1901.

766a — The stony corals of the Porto Rican waters.

U. S. Fish Comm., Bull., vol. 2, for 1900, pp. 289-320, pls. i-xxxviii, 1901.

In addition to describing recent species of corals, gives notes on fossil species from the United States and the West Indies.

767 — Shell Bluff, Georgia, one of Lyell's original localities.

Abstract: Science, new ser., vol. 13, p. 270, 1901.

Contains abstract of paper read before the Geological Society of Washington.

768 — Review of recent papers on Bahaman corals.

Science, new ser., vol. 14, pp. 497-498, 1901.

769 — The copper mines of Santa Clara province, Cuba.

Eng. & Mg. Jour., vol. 72, pp. 814-816, 4 figs., 1901.

Describes the geology and occurrence and character of the ore bodies.

770 **Vaux** (George) and (William S., jr.). Observations made in 1900 on glaciers in British Columbia.

Phil. Acad. Nat. Sci., Proc. for 1901, pp. 213-215, 1901.

Notes on movements of the glaciers.

W.

771 **Walcott** (Charles D.). Cambrian Brachiopoda; *Obolella* subgenus *Glyptias*; *Bicia*; *Obolus*, subgenus *Westonia*; with description of new species.
U. S. Nat. Mus., Proc., vol. 23, pp. 669-695, 1901.

772 — The work of the United States Geological Survey in relation to the mineral resources of the United States.
Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 3-26, with map, 1901.
Gives a general account of the work of the U. S. Geological Survey in the development of the mineral resources of the country.

773 — Twenty-second Annual Report of the Director of the United States Geological Survey to the Secretary of the Interior, 1900-1901.
U. S. Geol. Surv., 22d Ann. Rept., Pt. I, pp. 1-207, pls. i-xxiv, 1901.
Gives an account of the work of the U. S. Geological Survey for the year.

774 — Sur les formations Pré-Cambriennes fossilifères.
Int. Cong. Geol., Compte Rendu, viii session, pp. 299-312, 1901.
Describes the lithologic and faunal characters of the pre-Cambrian strata in various parts of the United States.

775 **Walker** (B. E.). List of the published writings of Elkanah Billings.
Can. Rec. Sci., vol. 8, pp. 366-388, 1901.

776 **Wanner** (Atreus). A new species of *Olenellus* from the Lower Cambrian of York County, Pennsylvania.
Wash. Acad. Sci., vol. 3, pp. 267-272, pls. 31-32, 1901.

777 **Ward** (Lester F.). Geology of the Little Colorado Valley [Arizona].
Am. Jour. Sci., 4th ser., vol. 12, pp. 401-413, 1901.
Describes the character and occurrence of the several subdivisions of the Mesozoic strata of the region.

778 — [Review of "Sur quelques Microorganismes des combustibles fossiles," by B. Renault.]
Science, new ser., vol. 13, pp. 577-581, 1901.

779 — The petrified forests of Arizona.
Smith. Inst. Ann. Rept. 1899, pp. 289-307, 1901.

780 **Warren** (C. H.). [Review of "The structural relations of the amygdaloidal melaphyre in Brookline, Newton, and Brighton, Mass.," by Henry T. Burr.]
Am. Jour. Sci., 4th ser., vol. 12, pp. 80-81, 1901.

781 **Warren** (C. H.). [Reviews of "Elements of mineralogy, crystallography and blowpipe analysis," by A. J. Moses and C. L. Parsons; and "A text-book of important minerals and rocks," by S. E. Tillman.]
Science, new ser., vol. 13, pp. 267-268, 1901.

782 — **Penfield** (S. L.) and. Some new minerals from the zinc mines at Franklin, N. J., and note concerning the chemical composition of ganomalite.
See Penfield (S. L.) and Warren (C. H.), 603.

783 **Washington** (Henry S.). The foyaite-ijolite series of Magnet Cove [Arkansas]; a chemical study in differentiation. I.
Jour. Geol., vol. 9, pp. 607-622, 1901.
Comprises a study of the chemical composition of several rock types and a discussion of their relations.

784 — The foyaite-ijolite series of Magnet Cove [Arkansas]; a chemical study in differentiation. II.
Jour. Geol., vol. 9, pp. 645-670, figs. 1-3, 1901.
Describes the petrographic characters of the rocks and compares them with similar rocks from other regions. Discusses differentiation in laccolithic magmas.

785 — The rocks of Lake Winnipesaukee, New Hampshire
Abstract: Am. Geol., vol. 27, p. 44 ($\frac{1}{2}$ p.), 1901.
Contains brief notes on the rocks.

786 — A chemical study of the glancophane schists.
Am. Jour. Sci., 4th ser., vol. 11, pp. 35-59, 1901.
Abstract: Am. Geol., vol. 27, pp. 184-185, 1901.
Describes the microscopic and chemical characters of these schists from several foreign countries and from western United States.

787 **Watson** (Thomas Leonard). The granitic rocks of Georgia and their relationships.
Am. Geol., vol. 27, pp. 199-225, pls. 17-24, 1901.
Describes the microscopic and chemical and mineralogic characters of the varieties of granite and discusses the evidence of their intrusive origin.

788 — The Georgia bauxite deposits; their chemical constituents and genesis.
Am. Geol., vol. 28, pp. 25-45, pl. 7, 1901.
Describes the general geology of the bauxite area and the occurrence, geologic position, and chemical composition of the ore and discusses its origin.

789 — On the origin of the phenocrysts in the porphyritic granites of Georgia.
Jour. Geol., vol. 9, pp. 97-122, figs. 1-6, 1901.
Abstracts: Am. Geol., vol. 28, pp. 58-59, 1901; Am. Nat., vol. 35, pp. 947-948, 1901.
Describes the characters of the granites of the several areas studied, their chemical composition, and the genetic relationship of phenocryst to groundmass.

790 **Watson** (Thomas Leonard). [Review of "The Bauxite deposits of Arkansas," by Charles Willard Hayes.]
Jour. Geol., vol. 9, pp. 737-739, 1901.

791 —— Weathering of granitic rocks of Georgia.
Geol. Soc. Am., Bull., vol. 12, pp. 93-108, pls. 6-11, 1901
Abstracts: Science, new ser., vol. 13, p. 137, 1901; Am. Nat., vol. 35, p. 947 (1/2 p.), 1901.
Describes the megascopic, microscopic, and chemical character of the granite of the State and the phenomena of their weathering.

792 **Watson** (R. Lind). Auriferous deposits of Wreck Bay, Jordan River, and other localities of Vancouver Island [Canada].
Mines and Minerals, vol. 21, pp. 488-489, 1 fig., 1901.
Describes placers of the region.

793 **Weatherby** (W. J.). The Mogollon range, New Mexico.
Mines and Minerals, vol. 22, pp. 97-101, 4 figs., 1901.
Describes the general geology and mineral resources of the region.

794 **Weed** (Walter Harvey). The enrichment of gold and silver veins.
Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 426-448, figs. 1-9, 1901.
Discusses the genesis of rich ore bodies occurring near ground water level and of those found in deep mine workings and the chemical reactions which have taken place during the process of ore deposition. Describes the author's observations and those of other geologists in various mines.

795 —— Types of copper deposits in the southern United States.
Am. Inst. Mg. Engrs., Trans., vol. 30, pp. 449-504, figs. 1-22, 1901.
Describes the character and occurrence of copper ores in certain districts and discusses relations of the ores of the regions with these type deposits.

796 —— Notes on the Carolina gold deposits.
Eng. and Mg. Jour., vol. 72, p. 494, 1901.
Brief notes on the character of the ores.

797 —— The El Paso tin deposits [Texas].
U. S. Geol. Surv., Bull. No. 178, pp. 1-15, pl. 1, figs. 1-4, 1901.
Describes the general geology of the region and the occurrence and character of the ore-bearing veins.

798 —— and **Pirsson** (L. V.). Geology of the Shonkin sag and Palisade Butte laccoliths in the Highwood Mountains of Montana.
Am. Jour. Sci., 4th ser., vol. 12, pp. 1-17, figs. 1-10, 1901.
Abstract: Geol. Mag., new ser., dec. 4, vol. 8, p. 423, 1901.
Describes the physiography of the region, the occurrence and character of the laccoliths and the chemical characters of the shonkinite and syenite.

799 **Weed** (Walter Harvey) and **Pirsson** (L. V.). Missourite, a new leucite rock from the Highwood Mountains of Montana.
Yale Bicentennial publications. Cont. to Mineral. and Petrog. pp. 457-466, 1901. (From Am. Jour. Sci., 4th ser., vol. 2, pp. 315-323, 1896.)

800 **Weeks** (Fred Boughton). An occurrence of tungsten ore in eastern Nevada.
U. S. Geol. Surv., 21st Ann. Rept., Pt. VI, pp. 319-320, 1901
Abstract: Eng. and Mg. Jour., vol. 72, pp. 8-9, 1901.

801 **Weller** (Stuart). Correlation of the Kinderhook formations of southwestern Missouri.
Jour. Geol., vol. 9, pp. 130-148, 1901.
Reviews recent correlation of these strata and describes the occurrence and faunas of the several formations which make up the Kinderhook group.

802 —— [Review of "The Oriskany fauna of Becroft Mountain, Columbia Co., N. Y.," by J. M. Clarke.]
Jour. Geol., vol. 9, pp. 278-279, 1901.

803 —— [Review of the University Geological Survey of Kansas, vol. 4, Paleontology, Part II, by Samuel W. Williston].
Jour. Geol., vol. 9, pp. 362-363, 1901.

804 —— Kinderhook faunal studies. III. The faunas of beds No. 3 to No. 7 at Burlington, Iowa.
St. Louis Acad. Sci., Trans., vol. 11, pp. 147-214, pls. 12-20, 1901.
Describes species collected from the various beds and discusses the correlations.

805 —— A preliminary report on the Paleozoic formations of the Kittatinny Valley in New Jersey.
N. J. Geol. Surv., Ann. Rept. for 1900, pp. 1-8, 1901.
Describes the character and occurrence of the subdivisions of the Cambrian and Ordovician strata in New Jersey.

806 —— **Kummell** (Henry B.) and. Paleozoic limestones of Kittatinny Valley, New Jersey.
See Kummel (H. B.) and Weller (S.), 457.

807 —— **Smith** (James Perrin) and. Prodromites, a new ammonite genus from the Lower Carboniferous.
See Smith (J. P.) and Weller (Stuart), 711.

808 **Wells** (Horace L.). Sperrylite, a new mineral.
Yale Bicentennial publications. Cont. to Mineral. and Petrog., pp. 151-156, 1901. (From Am. Jour. Sci., vol. 37, pp. 67-70, 1889.)

809 —— On the composition of pollucite and its occurrence at Hebron, Me.
Yale Bicentennial publications. Cont. to Mineral. and Petrog., pp. 183-192, 1901. (From Am. Jour. Sci., vol. 41, pp. 213-220, 1891.)

809a **White** (David). Two new species of *Algæ* from the Upper Silurian of Indiana.

U. S. Nat. Mus., Proc., vol. 24, pp. 265-270, pls. xvi-xviii, 1901

810 —— Age of the coals at Tipton, Blair County, Pennsylvania.

Geol. Soc. Am., Bull., vol. 12, pp. 473-477, 1901.

Describes the occurrence, character and structure of the strata associated with the coals and discusses their age as indicated by the fossil flora.

811 —— [Review of "Étude sur la flore fossile du basin houiller d'Héraclée (Asie Mineure)" by R. Zeiller.]

Jour. Geol., vol. 9, pp. 192-198, 1901.

812 —— Mr. Lacoë's relation to science.

Wyoming Hist. and Geol. Soc., Proc. and Coll., vol. 6, pp. 55-60, 1901.
Gives an account of his geologic and paleontologic labors.

813 —— The Canadian species of the genus *Whittleseya* and their systematic relations.

Ottawa Nat., vol. 15, pp. 98-110, pl. 7, 1901.

Describes the occurrence, relation, systematic position and characters of the species.

814 —— Some paleobotanical aspects of the Upper Paleozoic in Nova Scotia.

Can. Rec. Sci., vol. 8, pp. 271-280, 1901.

Discusses the bearing of the paleobotanical data on the age of certain beds in Nova Scotia.

815 **White** (I. C.). Second edition of the geological map of West Virginia.

Am. Geol., vol. 28, pp. 328-329, 1901.

Gives a brief description of the map.

816 —— Geology of West Virginia. [Paper read before the International Mining Congress, Boise, Idaho, June, 1901.]

Mines and Minerals, vol. 22, pp. 153-155, 1901.

Describes briefly the character and succession of the sedimentary strata of the State.

817 **White** (Mark). Geology of the Glass Mountains of western Oklahoma.

Kans. Acad. Sci., Trans., vol. 17, pp. 199-200, 1901.

Gives a section of the Cretaceous strata.

818 **White** (Theodore G.). [Faunas of the Lower Ordovician at Glens Falls, N. Y.]

Abstract: Am. Geol., vol. 27, p. 43 (½ p.), 1901.

Gives results of the author's detailed studies.

819 **Whiteaves** (J. F.). Description of a new species of *Unio* from the Cretaceous rocks of the Nanaimo coal field. Vancouver Island.

Ottawa Nat., vol. 14, pp. 177-179, 1 fig., 1901.

820 **Whiteaves** (J. F.). Note on a supposed new species of *Lytoceras* from the Cretaceous rocks at Denman Island in the Strait of Georgia [Canada].
Ottawa Nat., vol. 15, pp. 31-32, 1901.

821 **Whitehead** (Cabell), **Chatard** (T. M.), and. An examination of the ores of the Republic Mine, Washington.
See Chatard (T. M.) and Whitehead (C.), 125.

822 **Whitfield** (R. P.) assisted by **Hovey** (E. O.). Catalogue of the types and figured specimens in the paleontological collection of the geological department, American Museum of Natural History; Lower Carboniferous to Pleistocene inclusive.
Am. Mus. Nat. Hist., Bull., vol. 11, pt. 4, pp. 357-500, 1901.

823 **Whitfield** (R. P.). Note on a very fine example of *Helicoceras stevensonii* preserving the outer chamber.
Am. Mus. Nat. Hist., Bull., vol. 14, p. 219, pl. 30, 1901.

824 **Wieland** (G. R.). A study of some American fossil Cycads. Part IV. On the microsporangiate fructification of Cycadeoidea.
Am. Jour. Sci., 4th ser., vol. 11, pp. 423-436, figs. 1-3, 1901.
Continues the description of the author's studies of the fructification of Cycadeoidea, which appeared in the American Journal of Science for March, 1899.

825 **Williams** (E. H., jr.). The alleged Parker channel. [Pennsylvania.]
Geol. Soc. Am., Bull., vol. 12, p. 463, 1901.
Describes abandoned channel of Allegheny River.

826 **Williams** (Henry Shaler). The discrimination of time values in geology.
Jour. Geol., vol. 9, pp. 570-585, 1901.
Discusses the criteria upon which the classification of strata should depend and proposes a plan of a biochronic classification and nomenclature.

827 — Points involved in the Siluro-Devonian boundary question.
Abstract: Geol. Soc. Am., Bull., vol. 12, pp. 472-473, 1901.
Gives brief summary of questions in dispute.

828 — [Reviews of "The Eocene deposits of Maryland" and "Systematic paleontology;" "Annual Report of the Geological Survey of Arkansas, 1892, Vol. V;" "Summary report on the operations of the Geological Survey of Canada" by G. M. Dawson; and "A revision of the genera and species of Canadian Paleozoic Corals—The *Madreporaria aporosa* and the *Madreporaria rugosa*" by L. M. Lambe.]
Am. Jour. Sci., 4th ser., vol. 12, pp. 77-80, 1901.

829 **Williams** (Henry Shaler). [Reviews of "Geological Survey of Canada, new series, vol. 11;" "Geological and Natural History Survey of Minnesota, Final Report, vol. 6;" "Iowa Geological Survey, vol. 11;" and "Dragons of the air, an account of extinct flying reptiles" by H. G. Seeley.]
Am. Jour. Sci., 4th ser., vol. 12, pp. 394-398, 1901.

830 **Willmott** (A. B.). The Michipicoten Huronian area.
Am. Geol., vol. 28, pp. 14-19, pl. 8, 1901.
Describes the occurrence of the igneous and sedimentary rocks of the region and discusses the stratigraphic succession and age of the sediments.

831 **Willis** (Bailey). Paleozoic Appalachia or the history of Maryland during Paleozoic time.
Md. Geol. Surv., Special Publication, vol. 4, pt. 1, pp. 1-93, pls. i-xii, fig. 1, 1900.
Describes the processes of erosion, sedimentation and deformation, and discusses the Paleozoic history of Maryland and adjacent States.

832 —— Individuals of stratigraphic classification.
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CLASSIFIED KEY TO THE INDEX.

	Page.
Alabama.....	103
Alaska.....	103
Archean and Algonkian	103
Atlantic coast region.....	103
Canada	103
Great Basin region	103
Great Lakes region	103
New England and New York.....	103
Rocky Mountain region.....	103
General.....	103
Arizona	103
Arkansas	103
Baffin Land.....	103
Bibliography	103
Biography	104
California.....	104
Cambrian.....	104
Appalachian region.....	104
Canada	104
Great Basin region	104
Mississippi Valley region	104
New England and New York.....	104
Rocky Mountain region.....	104
Southwestern region.....	104
Canada	104
Alberta.....	104
British Columbia.....	104
Cape Breton Island	105
Labrador.....	105
Manitoba.....	105
New Brunswick	105
Nova Scotia.....	105
Ontario	105
Quebec	105
General.....	105
Carboniferous	105
Appalachian region	105
Canada	106
Great Basin region	106
Great Plains region.....	106
Mississippi Valley region	106
Rocky Mountain region.....	106
Southwestern region.....	106
General	106

	Page.
Chemical analyses.....	106
Classification.....	107
Colorado.....	107
Connecticut.....	108
Correlation	108
Cretaceous	108
Atlantic coast region.....	108
Canada	108
Great Plains region.....	108
Mexico	108
Mississippi Valley region	108
Pacific coast region	108
Rocky Mountain region.....	108
Southwestern region.....	108
Devonian	108
Appalachian region.....	108
Canada	108
Great Basin region	108
Great Lakes region	108
Mississippi Valley region	108
New England and New York	108
Southwestern region.....	108
General.....	108
District of Columbia.....	108
Dynamic geology—Geographic divisions	108
Appalachian region.....	108
Atlantic coast region.....	108
Canada	108
Great Basin region	109
Great Lakes region	109
Great Plains region.....	109
Hawaiian Islands	109
Mexico	109
Mississippi Valley region	109
New England	109
Pacific coast region	109
Panama	109
Rocky Mountain region	109
Southwestern region.....	109
West Indies	109
General	109
Dynamic geology—Divisions by subject-matter.....	109
Denudation	109
Erosion	110
Faulting	110
Folding	110
Intrusion	110
Jointing	110
Oscillation	110
Sedimentation	110
Volcanoes	110
Economic geology	110
Alabama	110
Alaska	110

	Page.
Economic geology—Continued.	
Arizona	110
Arkansas	110
California	110
Canada	110
Colorado	110
District of Columbia	111
Georgia	111
Idaho	111
Illinois	111
Indiana	111
Indian Territory	111
Iowa	111
Kansas	111
Kentucky	111
Mexico	111
Michigan	111
Minnesota	111
Missouri	111
Montana	111
Nebraska	111
Nevada	111
New Jersey	111
New Mexico	111
New York	111
North Carolina	111
North Dakota	111
Oklahoma	111
Oregon	111
Philippine Islands	111
South Carolina	111
South Dakota	111
Tennessee	112
Texas	112
Utah	112
Vermont	112
Virginia	112
Washington	112
West Indies	112
West Virginia	112
Wisconsin	112
Wyoming	112
General	112
Economic products described	112
Geologic formations, description and synonymy	115
Geologic maps	119
Georgia	119
Glacial geology	120
Alaska	120
Appalachian region	120
Canada	120
Great Basin region	120
Great Lakes region	120
Mississippi Valley region	120
New England and New York	120

	Page.
Glacial geology—Continued.	
Ohio Valley.....	120
Pacific coast region	120
Rocky Mountain region.....	120
General	120
Greenland	120
Hawaiian Islands.....	120
Idaho	120
Indiana.....	120
Indian Territory	120
Iowa	120
Jura.....	121
New England	121
Rocky Mountain region.....	121
Kansas	121
Kentucky	121
Maine	121
Maryland	121
Massachusetts	121
Mexico	121
Michigan	121
Mineralogy	122
Minerals described	122
Minnesota	123
Mississippi.....	123
Missouri	123
Montana.....	123
Nebraska	123
Nevada	123
Newfoundland	124
New Hampshire.....	124
New Jersey	124
New Mexico	124
New York	124
Nicaragua.....	124
North Carolina.....	124
North Dakota.....	124
Ohio	124
Oklahoma	124
Oregon	125
Paleontology.....	125
Algonkian	125
Cambrian.....	125
Carboniferous	125
Cretaceous.....	125
Devonian	125
Jurassic.....	125
Pleistocene	125
Silurian.....	126
Tertiary	126
Triassic	126
General.....	126
Genera and species described.....	127
Panama.....	139

	Page.
Pennsylvania	139
Petrology	139
California	139
Canada	140
Colorado	140
Connecticut	140
District of Columbia	140
Georgia	140
Idaho	140
Iowa	140
Maine	140
Maryland	140
Massachusetts	140
Mexico	140
Minnesota	140
Montana	140
New Hampshire	140
New Jersey	140
New York	140
Oregon	140
Pennsylvania	140
Vermont	140
Washington	140
Wyoming	140
General	140
Rocks described	140
Physiographic geology	141
Alaska	141
Appalachian region	141
Atlantic coast region	141
Canada	141
Great Basin region	141
Great Lakes region	141
Great Plains region	141
Mexico	141
Mississippi Valley region	141
New England and New York	141
Pacific coast region	142
Rocky Mountain region	142
Southwestern region	142
West Indies	142
General	142
Pleistocene	142
Appalachian region	142
Atlantic coast region	142
Canada	142
Great Basin region	142
Mississippi Valley region	142
New England and New York	142
Pacific coast region	142
Rocky Mountain region	142
Southwestern region	142
West Indies	142

	Page.
Philippine Islands	142
Silurian	142
Appalachian region	142
Canada	142
Great Basin region	142
Mississippi Valley region	142
New England and New York	143
Ohio Valley region	143
Southwestern region	143
General	143
South Carolina	143
South Dakota	143
Tennessee	143
Tertiary	143
Atlantic coast region	143
Canada	143
Great Plains region	143
New England	143
Pacific coast region	143
Panama	143
Philippine Islands	143
Rocky Mountain region	143
Southwestern region	143
West Indies	143
Texas	143
Trias	144
Canada	144
New England	144
Pacific coast region	144
Rocky Mountain region	144
Southwestern region	144
Utah	144
Vermont	144
Virginia	144
Washington	144
West Indies	144
West Virginia	144
Wisconsin	144
Wyoming	144

INDEX.

[The numbers refer to entries in the Bibliography.]

Alabama.

Alabama coal fields, McCalley, 511.
Marble formations of the Cahaba River, Byrne, 99.
Meteorite which fell near Felix, Alabama, Merrill, 543a.

Alaska.

Glacial phenomena of Seward Peninsula, Brooks and Collier, 81.
Gold mining in Alaska, Furman, 289.
Jura-fossilien aus Alaska, Pompeckj, 620.
Nome gold region, Schrader and Brooks, 681.
Notes on Nome, Rickard, 646.
Occurrence of cassiterite, Brooks, 80.
Occurrence of stream tin, Brooks, 80a.
Physiography of the Copper River basin, Spencer, 717.

Archean and Algonkian.

Atlantic coast region.

Washington folio, Darton and Keith, 200.

Canada.

Geological record of Rocky Mountain region, Dawson, 224.
Geology of principal cities in eastern Canada, Ami, 14.
Geology of Yellow Head Pass route, McEvoy, 516.
Iron ores of Nipissing district, Miller, 551.
Iron ranges of the Lower Huronian, Coleman, 155.
Michipicoten Huronian area, Willmott, 830.
Synopsis of geology of Canada, Ami, 15.

Great Basin region.

Geology and vein phenomena of Arizona, Comstock, 161.

Great Lakes region.

Keeweenawan area of eastern Minnesota, Hall, 332.

New England and New York.

Geology of crystalline rocks, Smyth, 713.

Geology of Rand Hill, Cushing, 185.

Pre-Cambrian formations, Kemp and Hall, 421.

Rocky Mountain region.

Oil of the northern Rocky Mountains, Willis, 834.

General.

Fundamental changes in the Archean and Algonkian, Winchell, 853.

Summaries of current North American Pre-Cambrian literature, Leith, 489.

Sur les formations précambriques fossilifères, Walcott, 774.

Arizona.

Caliche of southern Arizona, Blake, 64.
Evidences of shallow seas in Paleozoic time, Blake, 63.
Extinct glaciers, Stone, 733.
Geology and vein phenomena of Arizona, Comstock, 161.
Geology of Arizona, Blake, 62.
Geology of the Little Colorado Valley, Ward, 777.
Grand Canyon of the Colorado, Davis, 202.
Minerals associated with copper, Stone, 732.
Petrified forests of Arizona, Ward, 779.
Vertebrates from the Trias of Arizona, Lucas, 505.

Arkansas.

Analysis of smithsonite, Miller, 555.
Arkansas beauxite deposits, Hayes, 356.
Borings in Silver Spring Valley, Douglas, 235.
Genesis of the Arkansas Valley, Keyes, 425.
Minature overthrust fault and anticline, Purdue, 634.
Peneplains of the Ozark highland, Hershey, 361.
Siluric fauna near Batesville, Arkansas, Van Ingen, 762, 763.
Valleys of solution in northern Arkansas, Purdue, 633.
Zinc-lead deposits of southwest Arkansas, Phillips, 610.

Baffinland.

Laurentian limestones, Bell, 58.

Bibliography.

Addenda and corrigenda to progress of geological work in Canada during 1899, Ami, 17.
Base leveling and its faunal significance, Adams, 2.
Biographical sketch of Elkanah Billings, Ami, 28.
Bibliography of E. Billings, Ami, 30.
George Mercer Dawson, Ami, 19, 29.
Dakota Cretaceous of Kansas and Nebraska, Gould, 301.
Diplodocus (Marsh), Hatcher, 342.
Eocene deposits of Maryland, Clark and Martin, 140.
Fossil corals from the elevated reefs of Curaçao, Aruba, and Bonaire, Vaughan, 766.
Fossil mammalia of White River beds, Douglass, 234a.
Geology and paleontology of Niagara Falls, Grabau, 306.

Bibliography—Continued.

Geology and water resources of Nez Perces County, Part II, Russell, 662.
 Geology of Black Hills, Darton, 198.
 Geology of the Philippine Islands, Becker, 50.
 Historical outline of the geological and agricultural survey of the State of Mississippi, Hilgard, 368.
 Lacoë (Ralph Dupuy), Hayden, 354.
 Medford dike area, Wilson, 888.
 Memoir of Franklin Platt, Frazer, 286.
 Newark system of the Pomperaug Valley, Hobbs, 376.
 North American species of the genus *Equus*, Gidley, 282.
 Observations on the Creodonts, Matthew, 538.
 Physical geology of central Ontario, Wilson, 839.
 Physiography of Acadia, Daly, 190.
 Pleistocene geology of Nassau County, Woodworth, 858.
 Siluric fauna near Batesville, Arkansas, Van Ingen, 762, 763.
 Studies in evolution, Beecher, 51.
 Structural relations of amygdaloidal melaphyre, Burr, 97.
 Summaries of current North American Pre-Cambrian literature, Leith, 489.
 Troost's survey of Philadelphia, Hamilton, 336.
 White (Theodore Greely), Ries, 649.

Biography.

Barris (Prof. W. H.), Preston, 626.
 Billings (Elkanah), Ami, 28.
 Brooks (Thomas Benton), Willis, 833.
 Claypole (Edward Waller), Winchell, 850.
 Dawson, George M., Adams, 3.
 Dawson (George Mercer), Ami, 18.
 Dawson (George Mercer), Harrington, 339.
 Lacoë (Ralph Dupuy), Hayden, 354.
 Lacoë's relation to science, White, 812.
 Le Conte (Joseph), Lawson, 484.
 Memoir of Franklin Platt, Frazer, 286.
 Sketch of the life and work of Augustus Wing, Seeley, 686.
 White (Theodore Greely), Ries, 649.

California.

A flightless auk, Mancalla californiensis, Lucas, 504a.
 Age of granites in the Klamath Mountains, Hershey, 363.
 A new Californian Bittium, Dall and Bartsch, 189.
 Auriferous gravels, Table Mountains of California, Hanks, 338.
 Berkeley Hills, Lawson and Palache, 484a.
 Border line between the Paleozoic and Mesozoic, Smith, 710.
 Feldspar-corundum rocks from Plumas County, Lawson, 482.
 Type of auriferous deposit, Hershey, 367.
 Composition of California petroleum, Mabery and Hudson, 507.
 Contribution to mineralogy of California, Blasdale, 66.
 Drainage features of California, Lawson, 483.
 Erosion on the Pacific coast, Holder, 384.

California—Continued.

Geology of Salinas Valley, Nutter, 570.
 Geology of the Great Basin, Turner, 744.
 Geomorphogeny of Klamath Mountains, Diller, 230.
 Metamorphic formations of northwestern California, Hershey, 362.
 Neocene basins of Klamath Mountains, Anderson, 81.
 Occurrence of platinum, Day, 226.
 Oil fields of California, Lakes, 470.
 On northupite, pirssonite, etc., Pratt, 623.
 Origin and occurrence of petroleum, Cooper, 163.
 Pedagogical geology of California, Hilgard, 369.
 Petroleum in California, Claypole, 149.
 Remarkable salt deposit, Holder, 383.
 Sierra Madre, near Pasadena, Claypole, 150.
 Subsidence of Santa Catalina, Ritter, 653.

Cambrian.

Appalachian region.

Geologic relations of the iron ores in the Cartersville district, Hayes, 355.
 Maynardville folio, Keith, 411.
 Paleozoic limestones of Kittatinny valley, Kummel and Weller, 457.
 Preliminary report on the Paleozoic formations, Weller, 805.

Canada.

Geological record of Rocky Mountain region, Dawson, 224.
 Geology of Yellow Head Pass route, McEvoy, 516.
 Subdivisions of the Cambrian system, Ami, 26.
 Synopsis of geology of Canada, Ami, 15.

Great Basin region.

Evidences of shallow seas in Paleozoic time, Blake, 63.
 Geology and vein phenomena of Arizona, Comstock, 161.
 Geology of Arizona, Blake, 62.

Mississippi Valley region.

Cambrian fossils of St. François Co., Beecher, 52.
 Relations and age of the St. Joseph and Potosi limestones, Nason, 561.

New England and New York.

Geology of Rand Hill, Cushing, 185.

Rocky Mountain region.

Geology of Black Hills, Darton, 198.

Southwestern region.

Nomenclature of the Cambrian formations of the St. François mountains, Keyes, 429.

Canada.

Alberta.

Geology of Yellow Head Pass route, McEvoy, 516.
 Lake basins in Alberta and British Columbia, Parkinson, 587.

British Columbia.

Auriferous deposits of Vancouver Island, Watson, 792.
 Coal Creek colliery of Crows Nest Pass, Corless, 164.
 Geology of Yellow Head Pass route, McEvoy, 516.

Canada—Continued.

British Columbia—Continued.

Lake basins in Alberta and British Columbia, Parkinson, 587.
 New species of *Unio*, Whiteaves, 619.
 Observations on glaciers, Vaux, 770.
 Pioneer work in Crows Nest coal areas, Blakemore, 65.
Texada Island, Brewer, 77.
Cape Breton Island.
 Preliminary notice of Etcheminian fauna, Matthew, 530.
Labrador.
 Exploration of the south shore of Hudson Strait, Low, 499.
Manitoba.
 Geography of Red River Valley, Dowling, 237.
New Brunswick.
 Are the St. John plant beds Carboniferous? Matthew, 535.
 Carboniferous basin of New Brunswick, Ells, 258.
 Devonian of the Acadian provinces, Matthew, 533.
 Geological correlations, Bailey, 37.
 Tripolite deposits of Fitzgerald Lake, Crosby, 174.
Nova Scotia.
 A new geological formation in the Devonian, Ami, 16.
 Description of tracks from the Knoydart formation, Ami, 12.
 Devonian of Canadian provinces, Ells, 259.
 Knoydart formation of Nova Scotia, Ami, 20.
 Minerals of Nova Scotia, Gilpin, 294.
 Paleobotanical aspects of the Upper Paleozoic, White, 814.
 Physiography of Acadia, Daly, 190.
 Potter's clay at Middle Musquodoboit, Mason, 528.
 West Gore antimony deposits, Asquith, 33.
Ontario.
 Ancient channels of Ottawa River, Ells, 260.
 Ancient drainage at Niagara Falls, Currie, 183.
 Areas of nepheline-syenite, Miller, 550.
 Geological notes, etc., Grant, 312.
 Glacial beds near Toronto, Coleman, 152.
 Glacial phenomena in eastern Ontario, Taylor, 738.
 Lytoceras from the Cretaceous rocks, Whiteaves, 820.
 Iron-ore fields of Ontario, Miller, 552.
 Iron ores of Nipissing district, Miller, 551.
 Iron ranges of the Lower Huronian, Coleman, 155.
 Lists of organic remains in the geological formations of the Ottawa district, Ami, 18.
 Marine and freshwater beaches, Coleman, 153.
 Michipicoten Huronian area, Willmott, 890.
 Niagara Falls as an index of time, Grant, 311.
 Opening address, geologic section, Grant, 310.
 Physical geology of central Ontario, Wilson, 889.
 See beaches of eastern Ontario, Coleman, 156.
 Sperrylite, Wells, 808.
 Stratigraphical note, Ami, 22.
 Vermilion River placers, Coleman, 154.

Canada—Continued.

Quebec.

Amygdaloidal trap rock, Dresser, 240.
 Eboulement à Saint-Luc-de-Vincennes, Lafaille, 460.
 Geology of Rigaud Mountain, Le Roy, 492.
 Geology of the Paleozoic basin, Ells, 257.
 Geology of the Three Rivers map sheet, Ells, 256.
 Gold-bearing alluvions of Quebec, Chalmers, 123.
 Helderbergian fossils near Montreal, Schuchert, 682.
 Hornblende lamprophyre dike at Richmond, Dresser, 239.
 Magnetic iron sand of the St. Lawrence, Obalski, 572.
 Modifications remarquables causées à l'embouchure de la Rivière Ste.-Anne, Laflamme, 459.
 Petrography of Mount Orford, Dresser, 241.
 Petrography of Shefford Mountain, Dresser, 242.
 Shore lines and landslips of St. Lawrence Valley, Chalmers, 122.
 Was Mount Royal an active volcano? Buchan, 93.
General.
 Addenda and corrigenda to progress of geological work in Canada during 1899, Ami, 17.
 Composition of Canadian limestone, Donald, 233.
 Exploration of northern side of Hudson strait, Bell, 57.
 Genera and species of Canadian Paleozoic corals, Lambe, 479.
 Geological record of Rocky Mountain region, Dawson, 224.
 Geology of principal cities in eastern Canada, Ami, 14.
 Geology of west shore of Lake Winnipeg, Dowling, 236.
 Les plus anciennes faunes Paléozoïques, Matthew, 536.
 Mineral statistics, Ingall, 401.
 New mineral occurrences in Canada, Hoffman, 381.
 Physical history of Rocky Mountain region, Dawson, 225.
 Published writings of Elkanah Billings, Walker, 775.
 Report of section of chemistry and mineralogy, Hoffman, 380.
 Report on parts of Manitoba and Keewatin, Tyrrell, 747.
 Silurian and Devonian formations of eastern Canada, Ami, 25.
 Subdivisions of the Cambrian system, Ami, 26.
 Synopsis of geology of Canada, Ami, 15.
 Whittlesey and their systematic relations, White, 813.
Carboniferous.
Appalachian region.
 Age of the coals at Tipton, Pennsylvania, White, 810.

Carboniferous—Continued.*Appalachian region*—Continued.

Charleston folio, Campbell, 105.
 Classification of the Waverley series, Prosser, 629.
 Maynardville folio, Keith, 411.
 Paleozoic formations of Alleghany County, Prosser, 631.
 Use of the term Bedford limestone, Prosser, 630.
 Waverley group in Ohio, Girty, 295.

Canada.

Geological record of Rocky Mountain region, Dawson, 224.
 Synopsis of geology of Canada, Ami, 15.

Great Basin region.

Geology and vein phenomena of Arizona, Comstock, 161.
 Geology of Arizona, Blake, 62.

Great Plains region.

Oklahoma salt plains, Gould, 303.
 Southern extension of the Marion and Wellington formations, Gould, 302.

Mississippi Valley region.

Correlation of the Clarinda well section, Keyes, 434.
 Correlation of the Kinderhook formations, Weller, 801.
 Crinoidal horizon in the Upper Carboniferous, Keyes, 436.
 Depositional measure of unconformity, Keyes, 422.
 Geology of Louisa County, Iowa, Udden, 748.
 Geology of Marion County, Miller, 548.
 Geology of Page County, Iowa, Calvin, 100.
 Geology of Pottawattamie County, Iowa, Udden, 749.

Kansas coal mining, Crane, 168.

Oil and gas fields of western interior and Gulf coast, Adams, 7.

Schematic standard for the American Carboniferous, Keyes, 431.

Stratigraphical location of trans-Mississippian coals, Keyes, 439.

Time values of provincial Carboniferous terranes, Keyes, 433.

Rocky Mountain region.

Geology of Black Hills, Darton, 198.

Southwestern region.

Age of Red Beds, Adams, 6.
 Age of the Red Beds, Beede, 56.
 Arkansas and Indian Territory coals, Keyes, 438.
 Colgate folio, Taff, 736.
 Depositional measure of unconformity, Keyes, 422.
 Fossils from the Red Beds, Gould, 297.
 Geology of Seminole, Creek, Cherokee, and Osage nations, Gould, 298.
 Kansas-Oklahoma-Texasgypsum hills, Gould, 300.
 Texas petroleum, Phillips, 608.

General.

Bedford as a formation name, Cumings, 178.
 Depositional measure of unconformity, Keyes, 435.

Carboniferous—Continued.*General*—Continued.

Names for the formations of the Ohio co-measures, Prosser, 632.
 Use of the term Bedford limestone, Sieberthal, 698.

Chemical analyses.

Albite, Blasdale, 66.
 Alitaite, Eakle, 250.
 Amphibolite-pyroxene rocks, Turner, 745.
 Amphibolite-schist, Lindgren, 495.
 Amblygonite, Penfield, 594.
 Andesite, Gregory, 322.
 Andesite, Lawson and Palache, 484a.
 Arkite, Washington, 783, 784.
 Augite-diorite, Dresser, 242.
 Augite-syenite, Peck, 590.
 Augite-syenite, Cross, 176.
 Basalt, Lawson and Palache, 484a.
 Bastnasite and tysonite, Allen and Comstoc 11.
 Bauxite, Watson, 788.
 Biotite-granite, Spurr, 724.
 Biotite-ijolite, Washington, 783.
 Biotite-rhyolite, Spurr, 724.
 Bixbyite, Penfield and Foote, 598.
 Calcite strontium, Chester, 136.
 Celestite, Hoffman, 380.
 Chalcopyrite, Winchell, 842.
 Childrenite, Penfield, 593.
 Chlorite, Blasdale, 66.
 Clay, Mason, 528.
 Clay-slate, Lindgren, 495.
 Clays, Buckley, 94.
 Clinohedrite, Penfield and Foote, 599.
 Coquimbite, Eakle, 250.
 Covite, Washington, 783, 784.
 Cymatolite, Brush and Dana, 91.
 Datolite, Eakle, 250.
 Datolite, Hoffmann, 382.
 Deweyite, Chester, 136.
 Diabase, Lindgren, 495.
 Dickinsonite, Brush and Dana, 88.
 Diopside, Blasdale, 66.
 Diorite, Cross, 176.
 Diorite, Leonard, 491.
 Diorite-porphyry, Cross, 176.
 Dolomite, Knight, 445.
 Dolomite, Newland, 565.
 Eosphorite, Brush and Dana, 88, 90.
 Esmeraldaite, Eakle, 250.
 Essexite, Dresser, 242.
 Essexite, Washington, 783.
 Fairfieldite, Brush and Dana, 89.
 Fillowite, Brush and Dana, 89.
 Foyaite, Washington, 783, 784.
 Ganomalite, Penfield and Warren, 603.
 Glaucochroite, Penfield and Warren, 603.
 Glaucomphane schists, Washington, 786.
 Gneiss, Lindgren, 495.
 Gneiss, Watson, 787.
 Gold ores, Chatard and Whitehead, 135.
 Granite, Hawes, 349.
 Granite, Leonard, 491.
 Granite, Lindgren, 495.
 Granite, Spurr, 724.
 Granite, Watson, 787, 789, 791.

Chemical analyses—Continued.

Grano-diorite, Lindgren, 495.
 Hamlinite, Penfield, 597.
 Hancockite, Penfield and Warren, 603.
 Hanksite, Pratt, 623.
 Hornblende, Blasdale, 66.
 Hornblende-biotite-quartz-diorite, Spurr, 724.
 Hornblende-quartz-andesite, Spurr, 724.
 Hornblende-syenite, Le Roy, 492.
 Hornblendite, Turner, 745.
 Hubnerite, Hoffmann, 380.
 Hydromagnesite, Hoffmann, 380.
 Hydromagnesite, Newland, 565.
 Ijolite, Washington, 783, 784.
 Iron, Courtis, 165.
 Iron ore, Hoffmann, 380.
 Iron ore, Obalski, 572.
 Jacupirangite, Washington, 783, 784.
 Kryptoperthite, Dresser, 242.
 Labradorite rock, Dana, 192.
 Ledouxite, Richards, 645.
 Lepidolite, Hoffmann, 381.
 Leucophoenicite, Penfield and Warren, 603.
 Limestone, Donald, 233.
 Limestone, Hoffmann, 380.
 Limestone, Kummel, 455.
 Limestone, Nichols, 566.
 Limestone, Russell, 662.
 Limestone, Siebenthal, 701.
 Limonite, Newland, 565.
 Lithiophilite, Brush and Dana, 88, 90.
 Magnesite, Newland, 565.
 Marcasite, Stokes, 729.
 Marl, Blatchley and Ashley, 69.
 Marl, Davis, 201.
 Marl, Kummel, 455.
 Meteoric iron, Pratt, 621.
 Meteorite, Merrill, 544a.
 Meteorite, Merrill and Stokes, 546.
 Missourite, Washington, 783.
 Mohawkite, Richards, 645.
 Monzonite, Cross, 176.
 Monzonite, Pirsson, 617.
 Mordenite, Pirsson, 615.
 Nasonite, Penfield and Warren, 603.
 Natron, Hoffman, 380.
 Nickel ore, Ledoux, 486.
 Nordmarkite, Dresser, 242.
 Norite, Leonard, 491.
 Northupite, Pratt, 623.
 Oil, Knight and Slosson, 450.
 Oil, Mabery and Hudson, 507.
 Oolitic stone, Blatchley, 67.
 Pearceite, Penfield, 596.
 Pectolite, Eakle, 250.
 Perknite, Turner, 745.
 Pirssonite, Pratt, 623.
 Pollucite, Wells, 309.
 Pulaskite, Washington, 783, 784.
 Pyrite, Stokes, 729.
 Pyroxenite, Turner, 745.
 Pyroxenite, Washington, 783.
 Quartz-porphyry, Le Roy, 492.
 Quartz-pyroxenite-diorite, Lindgren, 495.
 Quartz-syenite-porphyry, Le Roy, 492.
 Reddingite, Brush and Dana, 89.
 Rhylolite, Ordofiez, 573.

Chemical analyses—Continued.

Rhyolite, Spurr, 724.
 Roscoelite, Lindgren, 497.
 Schist, Hoffman, 380.
 Schorlomite, Hoffmann, 381.
 Serpentine, Leonard, 491.
 Serpentine, Lyon, 506.
 Serpentine, Newland, 565.
 Serpentine, Smith and Willis, 709.
 Shonkinite, Pirsson, 616, 617.
 Shonkinite, Washington, 783.
 Shonkinite, Weed and Pirsson, 798.
 Spangolite, Penfield, 595.
 Spodumene, Brush and Dana, 91.
 Sperrylite, Wells, 308.
 Syenite, Dresser, 242.
 Syenite, Pirsson, 617.
 Syenite, Weed and Pirsson, 798.
 Talc, Blasdale, 66.
 Tetrahedrite, Chester, 136.
 Thaumasite, Penfield and Pratt, 602.
 Therelite, Washington, 783.
 Tinguata, Washington, 783.
 Tremolite, Blasdale, 66.
 Triploidite, Brush and Dana, 88.
 Tysonite, Allen and Comstock, 11.
 Websterite, Leonard, 491.
 Websterite, Turner, 745.
 Wellsite, Pratt and Foote, 624.

Classification.
 Classification of geologic formations of Tennessee, Safford, 665.
 Discrimination of time values in geology, Williams, 826.
 Dual classification required in the nomenclature of geological formations in Canada, Ami, 27.
 Formations as the basis for geologic mapping, Eckle, 253.

Colorado.
 American Nettie, Lakes, 461.
 Bastnasite and tysonite, Allen and Comstock, 11.
 Building and monumental stones, Lakes, 472.
 Building stones, Lakes, 473.
 Cave ore deposits, Lakes, 464.
 Cripple Creek, Lakes, 462.
 Cripple Creek volcano, Rickard, 647.
 Curtis coal mine, Lakes, 463.
 Dinosaur beds of the Grand River Valley, Riggs, 650.
 Economic geology. La Plata folio, Purington, 636.
 Economic geology of the Silverton quadrangle, Ransome, 639.
 Geological occurrence of oil, Lakes, 478.
 Geology of Silverton quadrangle, Cross, 177.
 Jurassic dinosaur deposits near Canyon City, Hatcher, 345.
 La Plata folio, Cross, 176.
 Morrison formation, Lee, 487.
 Occurrence of limburgite, Stevens, 728.
 Oil springs of Rio Blanco County, Lakes, 476.
 Plastic dike near Ouray, Ransome, 640.
 Prospecting for oil, Lakes, 471, 475.
 Spanish Peaks folio, Hills, 374.
 Stratigraphy of the Black Hills, Darton, 199.
 Telluride ores of Cripple Creek and Kalgoorlie, Rickard, 648.

Connecticut.

Description of new species from Branchville, Brush and Dana, 88.
 Fifth Branchville paper, Brush and Dana, 92.
 Fossil wood from the Newark formation, Knowlton, 454.
 Newark system of the Pomperaug Valley, Hobbs, 376.
 River system of Connecticut, Hobbs, 377.
 Second Branchville paper, Brush and Dana, 89.
 Spodumene and results of its alteration, Brush and Dana, 91.
 Third Branchville paper, Brush and Dana, 90.

Correlation.

Correlation des horizons de mammifères Tertiaires en Europe et en Amérique, Osborn, 583.
 Individuals of stratigraphic classification, Willis, 832.
 Schematic standard for the American Carboniferous, Keyes, 431.

Cretaceous.

Atlantic coast region.
 Washington folio, Darton and Keith, 200.
Canada.
 Geological record of Rocky Mountain region, Dawson, 224.
 Geology of Yellow Head Pass route, McEvoy, 516.
 Synopsis of geology of Canada, Ami, 15.
Great Plains region.
 Concretions of the Pierre shale, Barbour, 40.
 Dakota Cretaceous of Kansas and Nebraska, Gould, 301.
 Dakota sandstone in Washington County, Kansas, Charles, 133.

Mexico.

Cretaceous of Obispo Canyon, Dumble, 245.
 Ein Profil durch den Ostabfall der Sierra Madre Oriental, Böse, 72.

Mississippi Valley region.

Geology of Page County, Iowa, Calvin, 100.
 Geology of Pottawattamie County, Iowa, Udden, 749.

Pacific coast region.

Berkeley Hills, Lawson and Palache, 484a.
 Coos Bay folio, Diller, 231.

Geology of the John Day Basin, Merriam, 542.

Rocky Mountain region.

Dinosaur beds of the Grand River Valley, Riggs, 650.
 Geology of Black Hills, Darton, 198.
 Jurassic stratigraphy in Wyoming, Loomis, 498.
 La Plata folio, Cross, 176.
 Morrison formation, Lee, 487.
 Oil of the northern Rocky Mountains, Willis, 834.
 Spanish Peaks folio, Hills, 374.

Southwestern region.

Geology of the Glass Mountains, White, 817.
 Oil and gas fields of western interior and Gulf coast, Adams, 7.

Devonian.

Appalachian region.
 Maynardville folio, Keith, 411.
 Paleozoic formations of Alleghany County, Prosser, 631.
Canada.
 A new geological formation in the Devonian, Ami, 16.
 Devonian of Canadian provinces, Ells, 259.
 Devonian of the Acadian provinces, Matthew, 583.
 Geological record of Rocky Mountain region, Dawson, 224.
 Geology of the principal cities in eastern Canada, Ami, 14.
 Knobdart formation of Nova Scotia, Ami, 20.
 Silurian and Devonian formations of eastern Canada, Ami, 25.
 Stratigraphical note, Ami, 22.
 Synopsis of geology of Canada, Ami, 15.

Great Basin region.

Evidences of shallow seas in Paleozoic time, Blake, 63.

Geology of Arizona, Blake, 62.

Great Lakes region.

Geologic section in Alpena and Presque Isle counties, Grabau, 307.

Mississippi Valley region.

Devonian fossils and stratigraphy of Indiana, Keyes, 442.
 Geology of Cedar County, Iowa, Norton, 568.
 Silver Creek hydraulic limestone, Siebenthal, 701.

New England and New York.

Limestones interbedded with shales of Marcellus stage, Clarke, 145.
 Geology and paleontology of Niagara Falls, Grabau, 306.
 Marcellus limestone, Wood, 855.

Southwestern region.

Texas petroleum, Phillips, 608.

General.

Siluro-Devonian boundary question, Williams, 827.

District of Columbia.

Washington folio, Darton and Keith, 200.

Dynamic geology (geographic divisions.)*Appalachian region.*

Geologic relations of the iron ores in the Cartersville district, Hayes, 355.
 Geology of Rand Hill, Cushing, 185.
 Geology of the Tallulah gorge, Jones, 406.
 Maynardville folio, Keith, 411.
 Paleozoic Appalachia, Willis, 831.
 Paleozoic limestones of Kittatinny Valley, Kummel and Weller, 457.

Atlantic coast region.

Washington folio, Darton and Keith, 200.

Canada.

Composition of Canadian limestone, Donald, 233.

Eboulement à Saint Luc de Vincennes, Lafaille, 460.

Geology of the Paleozoic basin, Ells, 257.

Modifications remarquables causées à l'embouchure de la Rivière Ste. Anne, Lafaille, 459.

Dynamic geology—Continued.*Canada*—Continued.

Physiography of Acadia, Daly, 190.
Shore lines and landslips of St. Lawrence Valley, Chalmers, 122.
Was Mount Royal an active volcano? Buchan, 93.

Great Basin region.

Current notes on physiography, Davis, 218.
Fault slip in Ogden Canyon, Talmage, 737.
Geology and vein phenomena of Arizona, Comstock, 161.
Grand Canyon of the Colorado, Davis, 202.
Landslides of Echo and Vermilion cliffs, Dodge, 232.
Origin and structure of the Basin ranges, Spurr, 728.

Great Lakes region.

Beach structure in Medina sandstone, Fairchild, 265.
Junction of Lake Superior sandstone and Keeweenawan traps, Grant, 314.
Wisconsin shore of Lake Superior, Collie, 157.

Great Plains region.

Concretions of Ottawa County, Bell, 59.
Sand crystals and their relation to concretionary formations, Barbour, 43.

Hawaiian Islands.

Brevity of tuff cone eruptions, Bishop, 61.

Mexico.

Ein Profil durch den Ostabfall der Sierra Madre Oriental, Böse, 72.

Mississippi Valley region.

Age of the Kansan drift sheet, Hershey, 864.
Evidence of local subsidence, Campbell, 102.
Preglacial drainage in southwestern Ohio, Miller, 547.

River beds and bluffs, Heiney, 360.

New England.

Erosion by flying sand, Julien, 408.
Geological history of Charles River, Massachusetts, Clapp, 139.
Micaceous cross-banding of strata, Woodworth, 857.
Newark system of the Pomperaug Valley, Hobbs, 376.
Representatives of pre-Wisconsin till, Fuller, 288.
River system of Connecticut, Hobbs, 377.
River terraces of New England, Davis, 204.

Pacific coast region.

Berkeley Hills, Lawson and Palache, 484a.
Drainage features of California, Lawson, 483.
Erosion on the Pacific coast, Holder, 384.
Geology of Salinas Valley, Nutter, 570.
Geomorphogeny of Klamath Mountains, Diller, 230.
Subsidence of Santa Catalina, Ritter, 653.

Panama.

Geology of the Isthmus of Panama, Hershey, 365.

Rocky Mountain region.

Cripple Creek, Lakes, 462.
Cripple Creek volcano, Rickard, 647.
Geology of Black Hills, Darton, 198.
Geology of Silverton quadrangle, Cross, 177.
Laccoliths of the Black Hills, Jaggar, 402.

Dynamic geology—Continued.*Rocky Mountain region*—Continued.

La Plata folio, Cross, 176.
Oil of the northern Rocky Mountains, Willis, 834.

Spanish Peaks folio, Hills, 374.

Southwestern region.

Coast prairie of Texas, Hall, 372.
Colgate folio, Taff, 736.

Depositional measure of unconformity, Keyes, 422.

Minature overthrust fault and anticline, Purdue, 624.

Peneplains of the Ozark highland, Hershey, 361.

Valleys of solution in northern Arkansas, Purdue, 633.

West Indies.

Geological and physical development of Antigua, Spencer, 719.

Geological and physical development of Aguilla, St. Martin, St. Bartholomew, and Sombroero, Spencer, 721.

Geological and physical development of Gaudaloupe, Spencer, 720.

Geological and physical development of the St. Christopher chain and Saba banks, Spencer, 722.

General.

Current notes on physiography, Davis, 220.

Derivation of the terrestrial spheroid from the rhombic dodecahedron, Keyes, 424.

Earth carving, Scott, 685.

Effects due to lightning discharge, Hallock, 334.

Experiments illustrating intrusion and erosion, Howe, 398.

Experimental work on flow of rocks, Adams and Nicholson, 5.

Fundamental propositions in the theory of elasticity, Cilly, 138.

Ice ramparts, Buckley, 95.

Ice ramparts, Van Hise, 761.

On Lord Kelvin's address on the age of the earth, Chamberlin, 130.

Origin of ripple marks, Branner, 76.

Origin of the coal measure fireclays, Hopkins, 388.

Oscillations in the sea level, Pearson, 589.

Nitrates in cave earths, Nichols, 566.

Notes on oceanography, Dall, 191.

On a possible function of disruptive approach in the formation of meteorites, comets and nebulae, Chamberlin, 127.

Peneplains of central France, Davis, 203.

Plan of the earth and its causes, Gregory, 326.

Rival theories of cosmogony, Fisher, 275.

Study of the structure of fulgurites, Julien, 407.

Dynamic geology (divisions by subject-matter.)*Denudation.*

Shorelines and landslips of St. Lawrence Valley, Chambers, 122.

Valleys of solution in northern Arkansas, Purdue, 633.

Weathering of granitic rocks, Watson, 791.

Erosion.

Age of the Kansan drift sheet, Hershey, 364.

Dynamic geology—Continued.**Erosion—Continued.**

Broad valleys of the Cordilleras, Shaler, 692.
 Concretions of Ottawa County, Bell, 59.
 Drainage features of California, Lawson, 483.
 Eboulement à Saint-Luc-de-Vincennes, La-flamme, 460.
 Geological history of Charles River, Mass., Clapp, 139.
 Geology of Salinas Valley, Nutter, 570.
 Grand Canyon of the Colorado, Davis, 202.
 Modifications remarquables causées à l'embouchure de la Rivière Ste.-Anne, La-flamme, 459.
 Newark system of the Pomperaug Valley, Hobbs, 376.
 Origin and structure of the Basin ranges, Spurr, 723.
 Peneplains of central France, Davis, 203.
 Peneplains of the Ozark highland, Hershey, 361.
 Preglacial drainage in southwestern Ohio, Miller, 547.
 River action phenomena, Tood, 741.
 River beds and bluffs, Heiney, 360.

Faulting.

Fault slip in Ogden Canyon, Talmage, 737.
 Geology and vein phenomena of Arizona, Comstock, 161.
 Grand Canyon of the Colorado, Davis, 202.
 Miniature overthrust fault and anticline, Purdue, 634.
 Newark system of the Pomperaug Valley, Hobbs, 376.
 Origin and structure of the Basin ranges, Spurr, 723.
 Paleozoic limestones of Kittatinny Valley, Kümmel and Weller, 457.
 River system of Connecticut, Hobbs, 377.

Folding.

Miniature overthrust fault and anticline, Purdue, 634.
 Oil of the northern Rocky Mountains, Willis, 834.
 Origin and structure of the basin ranges, Spurr, 723.
 Paleozoic limestones of Kittatinny Valley, Kümmel and Weller, 457.

Intrusion.

Laccoliths of the Black Hills, Jaggar, 402.

Jointing.

River system of Connecticut, Hobbs, 377.

Oscillation.

Broad valleys of the Cordilleras, Shaler, 692.
 Evidence of local subsidence, Campbell, 103.
 Geomorphogeny of Klamath Mountains, Diller, 230.

Oscillations in the sea level, Pearson, 589.

Sedimentation.

Beach structure in Medina sandstone, Fairchild, 265.
 Depositional measure of unconformity, Keyes, 422.
 Micaceous cross-banding of strata, Woodworth, 857.

Volcanoes.

Cripple Creek volcano, Rickard, 467.

Economic geology.**Alabama.**

Alabama coal fields, McCalley, 511.
 Marble formations of the Cahaba River, Byrne, 99.

Alaska.

Gold mining in Alaska, Furman, 289.
 Nome gold region, Schrader and Brooks, 681.
 Notes on Nome, Rickard, 646.
 Occurrence of cassiterite, Brooks, 80.
 Occurrence of stream tin, Brooks, 80a.

Arizona.

Geology and vein phenomena of Arizona, Comstock, 161.

Arkansas.

Arkansas beauxite deposits, Hayes, 356.
 Zinc-lead deposits of southwest Arkansas, Phillips, 610.

California.

California type of auriferous deposit, Hershey, 367.
 Geology of Salinas Valley, Nutter, 570.
 Occurrence of platinum, Day, 226.
 Oil fields of California, Lakes, 470.
 Origin and occurrence of petroleum, Cooper, 163.

Petroleum in California, Claypole, 149.

Remarkable salt deposit, Holder, 383.

Canada.

Auriferous deposits of Vancouver Island, Watson, 792.
 Coal Creek colliery of Crows Nest Pass, Corless, 164.
 Geology of the Three Rivers map sheet, Ellis, 256.
 Gold-bearing alluvions of Quebec, Chalmers, 123.
 Iron-ore fields of Ontario, Miller, 552.
 Iron ores of Nipissing district, Miller, 551.
 Iron ranges of the Lower Huronian, Coleman, 155.
 Magnetic iron sand of the St. Lawrence, Obalski, 572.
 Mineral statistics, Ingall, 401.
 Pioneer work in Crows Nest coal area, Blakemore, 65.
 Potters' clay at Middle Musquodoboit, Mason, 528.

Texada Island, Brewer, 77.

Tripolite deposits of Fitzgerald Lake, Crosby, 174.

Vermilion River placers, Coleman, 154.

West Gore antimony deposits, Asquith, 33.

Colorado.

American Nettie, Lakes, 461.
 Building and monumental stones, Lakes, 472.
 Building stones, Lakes, 473.
 Cave ore deposits, Lakes, 464.
 Cripple Creek volcano, Rickard, 647.
 Curtis coal mine, Lakes, 463.
 Economic geology, La Plata folio, Purington, 636.
 Economic geology of the Silverton quadrangle, Ransome, 639.
 Oil springs of Rio Blanco County, Lakes, 476.
 Plastic dike near Ouray, Ransome, 640.
 Prospecting for oil, Lakes, 471, 475.

Economic geology—Continued.*Colorado*—Continued.

Spanish Peaks folio, Hills, 374.
Telluride ores of Cripple Creek and Kalgoorlie, Rickard, 648.

District of Columbia.

Washington folio, Darton and Keith, 200.

Georgia.

Geologic relations of the iron ores in the Cartersville district, Hayes, 355.
Georgia bauxite deposits, Watson, 788.
Vein structure at the Reynolds mine, Collins, 160.

Idaho.

Idaho mining districts, Lakes, 477.
Geology and water resources of Nez Perces County, Part II, Russell, 662.

Thunder Mountain, L'Hame, 488.

Illinois.

Fluorspar mines of Kentucky and Illinois, Burk, 96.

Indiana.

Lakes of Indiana and their marl deposits, Blatchley and Ashley, 69.
Oolitic stone for Portland cement, Blatchley, 67.

Petroleum industry in 1900, Blatchley, 68.

Silver Creek hydraulic limestone, Siebenthal, 701.

Indian Territory.

Calgate folio, Taff, 736.
Oil and gas fields of western interior and Gulf coast, Adams, 7

Iowa.

Geology of Cedar County, Norton, 568.
Geology of Louisa County, Udden, 748.
Geology of Marion County, Miller, 548.
Geology of Page County, Calvin, 100.
Geology of Pottawattamie County, Udden, 749.

Occurrence of gold and other mineral products in Iowa, Calvin, 101.

Kansas.

Americus limestone, Smith, 706.
Dakota Cretaceous of Kansas and Nebraska, Gould, 301.
Galena-Joplin lead and zinc district, Haworth, 350.
Kansas coal mining, Crane, 168.
Kansas mines and minerals, Grimsley, 326.
Oil and gas fields of western interior and Gulf coast, Adams, 7.
Petroleum and natural gas, Haworth, 351.
Springs of Kansas and Oklahoma, Gould, 299.

Kentucky.

Fluorspar mines of Kentucky and Illinois, Burk, 96.

Mexico.

Distribución geográfica y geológica de los criaderos minerales, Aguilera, 8.
La industria minera, Ordoñez, 574.
Mining industry of Pachuca, Ordoñez, 575.
Mining in Lower California, Lowry, 500.
Sierra Mojada and its ore deposits, Malcolmson, 518.
Silver-bearing veins of Mexico, Halse, 335,

Economic geology—Continued.*Michigan*.

Iron-ore deposits of the Lake Superior region, Van Hise, 759.
Michigan limestones, Lane, 480.

Minnesota.

Constituents of Minnesota soils, Hall, 331.
Iron-ore deposits of the Lake Superior region, Van Hise, 759.

Missouri.

Galena-Joplin lead and zinc district, Haworth, 350.
Origin of Joplin ore deposits, Bain, 38.

Montana.

Oil of the northern Rocky Mountains, Willis, 834.

Nebraska.

Dakota Cretaceous of Kansas and Nebraska, Gould, 301.

Nevada.

Mines of Esmeralda County, Turner, 746.

Notes on two desert mines, Emmons, 262.

Occurrence of tungsten ore, Weeks, 800.

Santa Fe mining district, McCormick, 515.

Tonopah, Knapp, 444.

New Jersey.

Artesian wells, Woolman, 859.

Mining industry, Kummell, 456.

Portland cement industry, Kummel, 455.

New Mexico.

A new coal field, Lakes, 466.

Cerrillos anthracite mine, Lakes, 465.

Curtis mines, Lakes, 467.

Mogollon range, Weatherby, 793.

New York.

Emery deposits of Westchester County, Eckle, 254.

Hematite iron ores of Antwerp and Fowler belt, Crosby, 175.

Oil and gas in New York, Bishop, 71.

Slate quarries of Washington County, Nevins, 563.

North Carolina.

Carolina gold deposits, Weed, 796.

Copper deposits of southern United States, Weed, 795.

Corundum in North Carolina, Ropes, 657.

North Dakota.

Lignite deposits, Hazeltine, 341.

Report of Geological Survey, Babcock, 34.

Oklahoma.

Oklahoma limestones, Gould, 304.

Oklahoma salt plains, Gould, 303.

Springs of Kansas and Oklahoma, Gould, 299.

Oregon.

Coos Bay folio, Diller, 281.

Oregon nickel prospects, Ledoux, 486.

Philippine Islands.

Geology of the Philippine Islands, Becker, 50.

South Carolina.

Carolina gold deposits, Weed, 796.

South Dakota.

Artesian wells in North and South Dakota, Upham, 752.

Geology of artesian basins, McCaslin, 514.

Geology of Black Hills, Darton, 198.

Gold ores of the Black Hills, Chance, 181.

Economic geology—Continued.*South Dakota*—Continued.

Problems of the Dakota artesian system, Todd, 742.

Tennessee.

Copper deposits of Southern United States, Weed, 795.

Horizons of phosphate rocks, Safford, 666.

Maynardville folio, Keith, 411.

Tennessee white phosphate, Eckel, 254a.

Tennessee white phosphate, Hayes, 357.

Texas.

Bat guano caves in Texas, Phillips, 611.

Beaumont oil field, Phillips, 609.

El Paso tin deposits, Weed, 797.

Iron ores of east Texas, Dumble, 247.

Oil and gas fields of western interior and Gulf coast, Adams, 7.

Quicksilver mines of Brewster County, Spalding, 715.

Texas petroleum, Phillips, 608.

Utah.

Notes on two desert mines, Emmons, 262.

Vermont.

Asbestos region in northern Vermont, Kemp, 416 and 419.

Occurrence of asbestos, Kemp, 420a.

Virginia.

Copper deposits of Southern United States, Weed, 795.

Washington.

Clealum iron ores, Smith and Willis, 709.

Discussion of Clealum iron ores, Courtis, 165.

Ores of the Republic mine, Chatard and Whitehead, 135.

Silverton mining district, Stretch, 734.

Washington serpentinite marbles, Lyon, 506.

West Indies.

Bituminous deposits of Cardenas, Cuba, Peckham, 591.

Copper mines of Santa Clara Province, Cuba, Vaughan, 769.

Iron ores of Cuba, Spencer, 716.

Manganese mining in Cuba, Chibas, 137.

West Virginia.

Charleston folio, Campbell, 105.

Wisconsin.

Clays and clay industries, Buckley, 94.

Copper-bearing rocks of Douglas County, Grant, 313.

Iron-ore deposits of the Lake Superior region, Van Hise, 759.

Wyoming.

Dutton, Rattlesnake, Arago, Oil Mountain, and Powder River oil fields, Knight and Slosson, 450.

Iron mines of Hartville, Chance, 132.

Petroleum fields, Knight, 447.

Sweetwater mining district, Knight, 448.

General.

Arkansas and Indian Territory coals, Keyes, 438.

Asphalt and bituminous rock deposits, Eldridge, 255.

Change of ore bodies with change of country rock, Lakes, 468.

Coal outcrops, Catlett, 121.

Economic geology—Continued.*General*—Continued.

Coal outcrops, Randolph, 638.

Coal outcrops, Scholz, 680.

Contiguity of ore deposits of different generic relationships, Keyes, 440.

Contribution to the natural history of marl, Davis, 201.

Deposition of copper by solutions of ferrous salts, Biddle, 60.

Diamondiferous deposits in the United States, Hobbs, 378.

Enrichment of gold and silver veins, Weed, 794.

Geology of ore deposits, Van Hise, 760.

Genesis of ore deposits, Alderson, 9.

Genesis of ore deposits, Tays, 739.

Graphite and garnet, Hopkins, 389.

High plains and their utilization, Johnson, 404.

Metasomatic processes in fissure veins, Lindgren, 495.

Ore formation by concentration through surface decomposition, Keyes, 428.

Origin and classification of ore deposits, Keyes, 423.

Occurrence and distribution of corundum, Pratt, 622.

Origins and times of formation of lead and zinc deposits of the Mississippi Valley, Keyes, 441.

Origin of Australian iron ores, Winchell, 851.

Origin of the Coal Measure fire clays, Hopkins, 388.

Origin of vein cavities, Nason, 562.

Petroleum in western North America, Lakes, 474.

Phosphate mining industry of the United States, Memminger, 541.

Principles controlling the deposition of ores, Van Hise, 758.

Recent contributions to the science of ore deposits, Raymond, 641.

Secondary enrichment of ore deposits, Emmons, 261.

The nonmetallic minerals; U. S. National Museum, Merrill, 545.

Zone of maximum richness in ore bodies, Keyes, 487.

Economic products described.

Abrasive materials, Hopkins, 389.

Albertite, Merrill, 545.

Allanite, orthite, Merrill, 545.

Alum slate or shale, Merrill, 545.

Aluminite, Merrill, 545.

Alunite, Merrill, 545.

Amblygonite, Merrill, 545.

Antimony, Asquith, 33.

Apatite; rock phosphates; guano, etc., Merrill, 545.

Arsenopyrite; mispickel or arsenical pyrites, Merrill, 545.

Artesian water, Todd, 742.

Artesian wells, Miller, 548.

Asbestos, Kemp, 416, 419, 420a.

Asbestos, Merrill, 545.

Asbolite, Merrill, 545.

Economic products described—Continued.

Asphalt, Eldridge, 255.
 Asphaltum, mineral pitch, Merrill, 545.
 Barite; heavy spar, Merrill, 545.
 Bauxite, Hayes, 356.
 Bauxite, Merrill, 545.
 Bauxite, Watson, 788.
 Bitumen, Peckham, 591.
 Boracite or stassfurtite; borate of magnesia, Merrill, 545.
 Borax or tincal; borate of soda, Merrill, 545.
 Braunita, Merrill, 545.
 Buhrstone, Merrill, 545.
 Building stone, Darton and Keith, 200.
 Building stone, Gould, 301, 304.
 Building stone, Lakes, 472, 473.
 Building stone, Miller, 548.
 Building stone, Norton, 568.
 Building stone, Russell, 662.
 Building stone, Smith, 706.
 Building stone, Udden, 748.
 Calcite; calc spar; Iceland spar, Merrill, 545.
 Carbonite or natural coke, Merrill, 545.
 Celestite, Merrill, 545.
 Cement, Blatchley, 67.
 Cement, Kummel, 455.
 Cement, Russell, 662.
 Cement, Siebenthal, 701.
 Cerite, Merrill, 545.
 Chalk, Merrill, 545.
 Chemawinite, Merrill, 545.
 Chromite, Merrill, 545.
 Clay, Babcock, 34.
 Clay, Buckley, 94.
 Clay, Darton and Keith, 200.
 Clay, Gould, 301.
 Clay, Mason, 528.
 Clay, Miller, 548.
 Clay, Udden, 748, 749.
 Clays, Merrill, 545.
 Coal, Babcock, 34.
 Coal, Becker, 50.
 Coal, Blakemore, 65.
 Coal, Calvin, 100.
 Coal, Campbell, 105.
 Coal, Catlett, 121.
 Coal, Corless, 164.
 Coal, Crane, 168.
 Coal, Darton, 198.
 Coal, Diller, 231.
 Coal, Gould, 301.
 Coal, Haseltine, 341.
 Coal, Hills, 374.
 Coal, Ingall, 401.
 Coal, Keyes, 438.
 Coal, Lakes, 463.
 Coal, Lakes, 465, 466.
 Coal, McCalley, 511.
 Coal, Miller, 548.
 Coal, Purington, 636.
 Coal series, Merrill, 545.
 Cobaltite, Merrill, 545.
 Colemanite, Merrill, 545.
 Columbite and tantalite, Merrill, 545.
 Copper, Becker, 50.
 Copper, Biddle, 60.
 Copper, Grant, 313.

Economic products described—Continued.

Copper, Kummel, 456.
 Copper, Lowry, 500.
 Copper, McCormick, 515.
 Copper, Stretch, 734.
 Copper, Vaughan, 769.
 Copper, Weed, 795.
 Corundum, Ropes, 657.
 Corundum and emery, Merrill, 545.
 Cryolite, Merrill, 545.
 Descloizite, Merrill, 545.
 Diamond, Hobbs, 378.
 Diaspore, Merrill, 545.
 Diatomaceous or infusorial earth, Merrill, 545.
 Dolomite, Merrill, 545.
 Elaterite, mineral caoutchouc, Merrill, 545.
 Emery, Eckle, 254.
 Epsomite, Epsom salts, Merrill, 545.
 Erythrite or cobalt bloom, Merrill, 545.
 Feldspar, Merrill, 545.
 Fire clay, Hopkins, 388.
 Flint, Merrill, 545.
 Fluor spar, Burk, 96.
 Fluorite, Merrill, 545.
 Franklinite, Merrill, 545.
 Fuller's earth, Darton, 198.
 Gadolinite, Merrill, 545.
 Garnet, Merrill, 545.
 Gibbsite, hydrargillite, Merrill, 545.
 Glauberite, Merrill, 545.
 Glauconite, Merrill, 545.
 Gold, Becker, 50.
 Gold, Chalmers, 123.
 Gold, Chance, 131.
 Gold, Coleman, 154.
 Gold, Comstock, 161.
 Gold, Diller, 231.
 Gold, Furman, 289.
 Gold, Hershey, 367.
 Gold, Knapp, 444.
 Gold, Knight, 448.
 Gold, Lakes, 461.
 Gold, L'Home, 488.
 Gold, Lowry, 500.
 Gold, Purington, 636.
 Gold, Ransome, 639.
 Gold, Rickard, 646, 648.
 Gold, Schrader and Brooks, 681.
 Gold, Watson, 792.
 Gold, Weatherby, 793.
 Gold, Weed, 796.
 Grahamite, Eldridge, 255.
 Grahamite, Merrill, 545.
 Grindstones, whetstones, and hones, Merrill, 545.
 Gum copal, Merrill, 545.
 Gypsum, Darton, 198.
 Gypsum, Merrill, 545.
 Halite, sodium chloride or common salt, Merrill, 545.
 Hausmannite, Merrill, 545.
 Ilmenite, menaccanite, or titanic iron, Merrill, 545.
 Iron, Chance, 132.
 Iron, Coleman, 155.
 Iron, Courtis, 165.
 Iron, Crosby, 175.

Economic products described—Continued.

Iron, Dumble, 247.
 Iron, Miller, 551, 552.
 Iron, Obalski, 572.
 Iron, Smith and Willis, 709.
 Iron, Spencer, 716.
 Iron, Van Hise, 759.
 Iron ores, Hayes, 855.
 Kainite, Merrill, 545.
 Kalinite, Merrill, 545.
 Kleserite, Merrill, 545.
 Lazurite, lapis lazuli, or native ultramarine, Merrill, 545.
 Lead, Haworth, 350.
 Lead, Keith, 411.
 Lead, Malcomson, 518.
 Lead, Phillips, 610.
 Lignite, Russell, 662.
 Lime, Norton, 568.
 Limestone, Donald, 233.
 Limestones, mortars, and cements, Merrill, 545.
 Linnaeite, Merrill, 545.
 Lithographic limestones, Merrill, 545.
 Löllingite, leucopyrite, Merrill, 545.
 Magnesite, Merrill, 545.
 Manganese, Chibas, 137.
 Manganese, Hayes, 355.
 Manganese, Merrill, 545.
 Manganite, Merrill, 545.
 Manjak, Merrill, 545.
 Marble, Byrne, 99.
 Marble, Keith, 411.
 Marble, Lyon, 506.
 Marl, Blatchley and Ashley, 69.
 Marl, Davis, 201.
 Micas, Merrill, 545.
 Mirabilite, or Glauber salt, Merrill, 545.
 Molybdenite, Merrill, 545.
 Monazite, Merrill, 545.
 Natron, the niterum of the ancients, Merrill, 545.
 Natural gas, Bishop, 71.
 Natural gas, Haworth, 351.
 Natural gas, Ingall, 401.
 Natural gas, Udden, 748.
 Nickel, Ledoux, 486.
 Niter, potassium nitrate, Merrill, 545.
 Nitro-calcite, Merrill, 545.
 Ochre, Chester, 136.
 Ocher, Hayes, 355.
 Ocher, Merrill, 545.
 Oil, Adams, 7.
 Oil, Bishop, 71.
 Oil, Blatchley, 68.
 Oil, Cooper, 163.
 Oil, Haworth, 351.
 Oil, Ingall, 401.
 Oil, Knight and Slosson, 450.
 Oil, Knight, 447.
 Oil, Lakes, 470, 471, 474, 475, 476.
 Oil, Phillips, 609.
 Oil, Willis, 834.
 Orpiment; auripigment, Merrill, 545.
 Ozokerite; mineral wax; native paraffin, Merrill, 545.
 Petroleum, Claypole, 149.

Economic products described—Continued.

Petroleum, Darton, 198.
 Petroleum, Merrill, 545.
 Petroleum, Phillips, 608.
 Phosphate, Eckel, 254a.
 Phosphate, Hayes, 357.
 Phosphate, Memminger, 541.
 Phosphate, Phillips, 611.
 Phosphate, Safford, 666.
 Platinum, Day, 226.
 Playing marbles, Merrill, 545.
 Polianite, Merrill, 545.
 Polyhalite, Merrill, 545.
 Portland cement, Merrill, 545.
 Psilomelane, Merrill, 545.
 Pumice, Merrill, 545.
 Pyrites, Merrill, 545.
 Pyrophyllite; agalmatolite; and pagod Merrill, 545.
 Pyrolusite, Merrill, 545.
 Quartz, Merrill, 545.
 Quicksilver, Spalding, 715.
 Realgar, Merrill, 545.
 Retinite, Merrill, 545.
 Rhodochrosite; dialogite, Merrill, 545.
 Rhodonite, Merrill, 545.
 Road material, Darton and Keith, 200.
 Roman cement, Merrill, 545.
 Roofing slate, Nevius, 563.
 Rutile, Merrill, 545.
 Salt, Gould, 303.
 Salt, Holder, 883.
 Samarskite, Merrill, 545.
 Scheelite, Merrill, 545.
 Sepiolite; meerschaum, Merrill, 545.
 Silver, Comstock, 161.
 Silver, Knapp, 444.
 Silver, Lowry, 500.
 Silver, McCormick, 515.
 Silver, Malcomson, 518.
 Silver, Ordoñez, 575.
 Silver, Purington, 636.
 Silver, Ransome, 639, 640.
 Silver, Weatherby, 798.
 Skutterudite, Merrill, 545.
 Smaltite, Merrill, 545.
 Soda niter, Merrill, 545.
 Soils, Norton, 568.
 Soils, Hall, 331.
 Spodumene and petalite, Merrill, 545.
 Steatite; talc; and soapstone, Merrill, 545.
 Strontianite, Merrill, 545.
 Succinite; amber, Merrill, 545.
 Synchondrite, Merrill, 545.
 Talc, Blasdale, 66.
 Thenardite, Merrill, 545.
 Tin, Brooks, 80a.
 Tin, Weed, 797.
 Tripolite, Crosby, 174.
 Triphyllite and lithiophilite, Merrill, 545.
 Tripoli, Merrill, 546.
 Troma; urao, Merrill, 545.
 Tschermigite, Merrill, 545.
 Tungsten ore, Weeks, 800.
 Uintaite, Eldridge, 255.
 Ulexite; boronatrocacite, Merrill, 545.
 Vanadinite, Merrill, 545.

Economic products described—Continued

Water supply, Babcock, 34.
 Water supply, Calvin, 100.
 Water supply, Darton, 198.
 Water supply, Darton and Keith, 200.
 Water supply, Gould, 299, 301.
 Water supply, Hills, 374.
 Water supply, Johnson, 404.
 Water supply, McCaslin, 514.
 Water supply, Nutter, 570.
 Water supply, Russell, 662.
 Water supply, Udden, 749.
 Water supply, Upham, 752.
 Water supply, Woolman, 859.
 Witherite, Merrill, 545.
 Wolframite and Hubnerite, Merrill, 545.
 Wurtzillite, Merrill, 545.
 Uintaite; gilsonite, Merrill, 545.
 Uraninite; pitchblende, Merrill, 545.
 Yttrontalite, Merrill, 545.
 Zinc, Haworth, 350.
 Zinc, Keith, 411.
 Zinc, Phillips, 610.
 Zircon, Merrill, 545.

Geologic formations, description and synonymy.

Abram's formation, Pre-Cretaceous, California, Hershey, 362.
 Agoniolites limestone, Devonian, New York, Clarke, 145.
 Aftonian, Pleistocene, Iowa, Udden, 748.
 Agua Dulce formation, Pleistocene, Panama, Hershey, 865.
 Albany granite, New Hampshire, Hawes, 349.
 Albertan, Pleistocene, Iowa, Udden, 748.
 Alleghany formation, Carboniferous, Maryland, Prosser, 631, 632.
 Americus limestone, Kansas, Smith, 706.
 Antigua formation = White limestone, West Indies, Spencer, 719, 721.
 Apishapa formation, Cretaceous, Colorado, Hills, 374.
 Aquia formation or stage. Eocene, Maryland. Includes Piscataway and Paspatassa members or substages. Clark and Martin, 140.
 Arisaig formation, Silurian, Canada, Ami, 22.
 Arizona formation, included in Huronian, Blake, 62.
 Atoka formation, Carboniferous, Indian Territory, Taff, 736.
 Azuero formation, Panama, Hershey, 365.
 Bays formation, Silurian, Tennessee, Keith, 411.
 Beacon Hill formation, Miocene, New Jersey, Smock, 712.
 Bedford, Carboniferous, Indiana and Ohio, Siebenthal, 698.
 Bedford limestone, Carboniferous, Indiana, Cumings, 178.
 Bedford shale, Carboniferous, Ohio, Prosser, 629, 630.
 Berea grit, Carboniferous, Ohio, Prosser, 629.
 Berkeleyan series, California, included in Pliocene, Lawson and Palache, 484a.
 Beulah shales, Jurassic, Black Hills, Darton, 198.

Geologic formations, description and synonymy—Continued.

Black Tail Deer Creek beds, included in White River beds, Tertiary, Montana, Douglass, 234a.
 Boggy shale, Carboniferous, Indian Territory, Taff, 736.
 Braden formation, Pre-Cretaceous, California, Hershey, 362.
 Braxton formation, Carboniferous, West Virginia, Campbell, 105.
 Briceville shale, Carboniferous, Tennessee, Keith, 411.
 Bridgeton formation, New Jersey, Smock, 712.
 Buchanan gravels, Pleistocene, Iowa, Norton, 568.
 Buchanan gravel, Pleistocene, Iowa, Udden, 748.
 Calciferous (Beekmantown) limestone, Ordovician, New York, Cushing, 185.
 Calderwood's Neck schists, Maine, Smith, 707.
 Calvan sandstone, Carboniferous, Indian Territory, Taff, 736.
 Campan series, Pliocene, California, Lawson and Palache, 484a.
 Caney shales, Carboniferous, Indian Territory, Taff, 736.
 Cape May formation, New Jersey, Smock, 712.
 Carlile formation, Cretaceous, Black Hills, Darton, 198.
 Caroline gneiss, Archean, Piedmont region. Darton and Keith, 200.
 Cassada Garden gravels, West Indies, Spencer, 719.
 Cathead limestone, Ordovician, Canada, Dowling, 236.
 Charleston sandstone, Carboniferous, West Virginia, Campbell, 105.
 Chattanooga black shale, Devonian, Kentucky and Tennessee, Foerste, 278.
 Chattanooga shale, Devonian, Tennessee, Keith, 411.
 Chengwatana series, Minnesota, Hall, 332.
 Chesapeake formation, Tertiary, Atlantic coast region, Darton and Keith, 200.
 Chickachoc chert lentil, Carboniferous, Indian Territory, Taff, 736.
 Chickamauga limestone, Silurian, Tennessee, Keith, 411.
 Clarno formation, Tertiary, Oregon, included in Eocene, Merriam, 542, 543.
 Clear Creek formation, Pre-Cretaceous, California, Hershey, 362.
 Clinch sandstone, Silurian, Tennessee, Keith, 411.
 Clinton, Silurian, New York, Grabau, 306.
 Clinton formation, Silurian, Maryland, Prosser, 631.
 Clinton limestone, Silurian, Kentucky and Tennessee, Foerste, 278.
 Coaledo formation, Eocene, Oregon, Diller, 231.
 Coggan limestone, Devonian, Iowa, Norton, 568.
 Columbia formation, Pleistocene, Atlantic coast region, Darton and Keith, 200.
 Columbia lava, Oregon, Merriam, 542.

Geologic formations, description and synonymy—Continued.

Como beds, exact synonym *Atlantosaurus* beds, Cretaceous, Wyoming, Williston, 836.
 Conasauga shale, Cambrian, Tennessee, Keith, 411.
 Conemaugh formation, Carboniferous, Maryland, Prosser, 631, 632.
 Cuchara formation, Eocene(?), Colorado, Hills, 374.
 Cumberland sandstones, Ordovician, Kentucky, Foerste, 278.
 Cuyahoga formation, Carboniferous, Ohio, Prosser, 629.
 Dakota formation, Cretaceous, Black Hills, Darton, 198.
 Dakota formation, Cretaceous, Colorado, Lee, 487.
 Dakota sandstone, Kansas, Charles, 133.
 Dakota sandstone, Cretaceous, Colorado, Cross, 176.
 Dannemora formation, Algonkian, New York, Cushing, 185.
 Davenport (upper and lower), Devonian, Iowa, Norton, 568.
 Deadwood formation, Cambrian, Black Hills, Darton, 198.
 Dolores formation, Jura-Trias, Colorado, Cross, 176.
 Douglas formation, Carboniferous, Kansas, Rogers, 656.
 Dunkard formation, Permian (?), Maryland, Prosser, 631, 632.
 Edmund's Hill andesites, Gregory, 322.
 Empire formation, Neocene, Oregon, Diller, 281.
 Englewood limestone, Carboniferous, Black Hills, Darton, 198.
 Eureka shale, Carboniferous, Missouri, Weller, 801.
 Fredericktown dolomite, Cambrian, Missouri, Keyes, 429.
 Fowler limestone, Ordovician, Kentucky, included in Richmond group, Foerste, 278.
 Fox Hills formation, Cretaceous, Black Hills, Darton, 198.
 Franciscan series, Lawson and Palache, 484a.
 Friars' Hill series, West Indies, Spencer, 719.
 Fuson formation, Cretaceous, Black Hills, Darton, 198.
 Geneva limestone, exact synonym(?) *Shelby* bed, Devonian, Indiana, Kindle, 442.
 Gower limestone, Silurian, Iowa, included in Niagara, Norton, 568.
 Grainger shale, Devonian, Tennessee, Keith, 411.
 Graneros shale, Cretaceous, Black Hills, Darton, 198.
 Greenbrier limestone, Carboniferous, Maryland, Prosser, 631.
 Greenhorn limestone, Cretaceous, Black Hills, Darton, 198.
 Grizzly Peak andesite, Lawson and Palache, 484a.
 Guertie sand, Neocene, Indian Territory, Taft, 736.
 Hampshire formation, Devonian, Maryland, Prosser, 631.

Geologic formations, description and synonymy—Continued.

Hardiston quartzite, Cambrian, New Jersey, Kummel and Weller, 457.
 Hardiston quartzite, Cambrian, New Jersey, Weller, 806.
 Hartshorn sandstone, Carboniferous, Indian Territory, Taff, 736.
 Helderberg limestone, Devonian, Maryland, Prosser, 631.
 Hodges Hill sandstone, West Indies, Spencer, 719.
 Holdenville shale, Carboniferous, Indian Territory, Taff, 736.
 Holston marble, Silurian, Tennessee, Keith, 411.
 Hudson River beds, Ordovician, New York, Ruedemann, 659.
 Hudson River formation, Ordovician, New Jersey, Weller, 805.
 Huercano formation, Eocene, Colorado, Hills, 374.
 Illinoian, Pleistocene, Iowa, Udden, 748.
 Iowan drift, Pleistocene, Iowa, Norton, 568.
 Independence, Devonian, Iowa, Norton, 568.
 Iron Mountain conglomerate, Cambrian, Missouri, Keyes, 429.
 Jeffersonville limestone, Devonian, Indiana, Kindle, 442.
 Jeffersonville limestone, Carboniferous, Indiana, Siebenthal, 709.
 Jennings formation, Devonian, Maryland, Prosser, 631.
 John Day series, Tertiary, Oregon, Merriam, 542, 543.
 Juniata formation, Silurian, Maryland, Prosser, 631.
 Kanawha formation, Carboniferous, West Virginia, Campbell, 105.
 Kansan, Pleistocene, Iowa, Macbride, 510.
 Kansan, Pleistocene, Iowa, Udden, 748.
 Kansan drift, Pleistocene, Iowa, Calvin, 100.
 Kansan drift, Pleistocene, Iowa, Miller, 648.
 Kansan drift, Pleistocene, Iowa, Norton, 568.
 Keweenawan, Algonkian, Minnesota, Hall, 332.
 Keweenawan trap, pre-Cambrian, Wisconsin, Grant, 314.
 Keewatin, Algonkian, Minnesota, Hall, 333.
 Kinderhook, Carboniferous, Missouri, Weller, 801.
 Kittatinny limestone, Cambro-Ordovician, New Jersey, Kummel and Weller, 457.
 Kittatinny limestone, Cambrian, New Jersey, Weller, 805.
 Knobstone, Carboniferous, Indiana, Siebenthal, 701.
 Knox dolomite, Silurian, Tennessee, Keith, 411.
 Knoydart formation, Devonian, Canada, Ami, 16, 20, 22.
 Labrador formation, Pleistocene, Canada, exact synonym, Boulder Clay, Ami, 14.
 Lafayette formation, Tertiary, Atlantic coast region, Darton and Keith, 200.
 Lafond gravel and marl, West Indies, Spencer, 720.

Geologic formations, description and synonymy—Continued.

Lake Superior sandstone, Cambrian, Wisconsin, Collie, 157.
 Lake Superior sandstone, Cambrian, Wisconsin, Grant, 314.
 Lakota formation, Cretaceous, Black Hills, Darton, 198.
 Lamotte sandstone, Cambrian, Missouri, Keyes, 429.
 La Plata sandstone, Jura-Trias, Colorado, Cross, 176.
 Laramie formation, Cretaceous, Black Hills, Darton, 198.
 Laramie formation, Cretaceous, Colorado, Hills, 374.
 Laurel limestone, Silurian, Kentucky and Tennessee, Foerste, 278.
 Leda clay, Canada, Coleman, 156.
 Lee conglomerate, Carboniferous, Tennessee, Keith, 411.
 Le Roux beds, Triassic, Arizona, Ward, 777.
 Lewis shale, Cretaceous, Colorado, Cross, 176.
 Lescer dolomite, Cambrian, Missouri, Keyes, 429.
 Lockport limestone, Silurian, New York. Synonym, Niagara limestone, Grabau, 306.
 Loess, Pleistocene, Iowa, Calvin, 100.
 Loess, Pleistocene, Iowa, Udden, 748.
 Logan formation, Carboniferous, Ohio, Prosser, 629.
 McAdam formation, Silurian, Canada, Aimi, 22.
 McAlister shale, Carboniferous, Indian Territory, Taff, 736.
 McElmo formation, Jura-Trias, Colorado, Cross, 176.
 Mancos shale, Cretaceous, Colorado, Cross, 176.
 Manlius limestone, Silurian, New York, Grabau, 306.
 Mariato formation, Pleistocene, Panama, Hershey, 365.
 Marion formation, Permian, Oklahoma, Gould, 302.
 Maryville limestone, Cambrian, Tennessee, Keith, 411.
 Mascall formation, Tertiary, Oregon. Included in Miocene, Merriam, 542.
 Matsawan formation, Cretaceous, Darton and Keith, 200.
 Mauch Chunk formation, Carboniferous, Maryland, Prosser, 631.
 Medina, Silurian, New York, Grabau, 306.
 Mesa Verde formation, Cretaceous, Colorado, Cross, 176.
 Minnelusa formation, Carboniferous, Black Hills, Darton, 198.
 Minnewaste limestone, Cretaceous, Black Hills, Darton, 198.
 Mississippian series, Carboniferous, Iowa, Udden, 748.
 Missourian stage, Carboniferous, Iowa, Calvin, 100.
 Missourian stage, Carboniferous, Iowa, Udden, 749.
 Moccasin limestone, Silurian, Tennessee, Keith, 411.

Geologic formations, description and synonymy—Continued.

Moencopie beds, Triassic, Arizona, Ward, 777.
 Monmouth formation, Cretaceous, Atlantic coast region, Darton and Keith, 200.
 Monongahela formation, Carboniferous, Maryland, Prosser, 631, 632.
 Monterey series, California, Lawson and Palache, 484a.
 Montijo conglomerate, Panama, Hershey, 365.
 Morrison formation, Jurassic, Colorado, Lee, 487.
 Mottled limestone (upper and lower), Ordovician, Canada, Dowling, 236.
 Myrtle formation, Cretaceous, Oregon, Diller, 231.
 Nanjemoy formation or stage, Eocene, Maryland. Includes Potapaco and Woodstock members or substages. Clark and Martin, 140.
 New Albany shale, Devonian of Indiana, Kindle, 442.
 New Albany black shale, Devonian, Indiana, Siebenthal, 709.
 Newman limestone, Carboniferous, Tennessee, Keith, 411.
 Niagara formation, Silurian, Maryland, Prosser, 631.
 Niobrara formation, Cretaceous, Black Hills, Darton, 198.
 Nolichucky shale, Cambrian, Tennessee, Keith, 411.
 North Haven greenstones, Maine, Smith, 707.
 North View sandstone and shale, Carboniferous, Missouri, Weller, 801.
 Nussbaum formation, Neocene, Colorado, Hills, 374.
 Onondaga limestone, Devonian, New York, Grabau, 306.
 Opeche formation, Carboniferous, Black Hills, Darton, 198.
 Orindan formation, Lawson and Palache, 484a.
 Oriskany sandstone, Devonian, Maryland, Prosser, 631.
 Otis, Devonian, Iowa, Norton, 568.
 Painted Desert beds, Triassic, Arizona, Ward, 777.
 Pahasapa limestone, Carboniferous, Black Hills, Darton, 198.
 Pamunkey formation, Tertiary, Atlantic coast region. Darton and Keith, 200.
 Panama formation, Hershey, 365.
 Paspatanee member or substage, Eocene, Maryland. Included in Aquia formation or stage. Clark and Martin, 140.
 Pearson limestone, Carboniferous, Missouri, Weller, 801.
 Pegram limestone, Devonian, Kentucky and Tennessee, Foerste, 278.
 Pendleton sandstone, Carboniferous, Indiana, Siebenthal, 709.
 Pennington shale, Carboniferous, Tennessee, Keith, 411.
 Pensauken formation, New Jersey, Smock, 712.
 Petit Bourg series, West Indies, Spencer, 720.

Geologic formations, description and synonymy—Continued.

Phelps sandstone, Carboniferous, Missouri, Weller, 801.

Pierre shale, Cretaceous, Black Hills, Darton, 198.

Pierre shale, Cretaceous, Colorado, Hills, 374.

Pipestone beds, included in White River beds, Tertiary, Montana, Douglass, 234a.

Piscataway member or substage, Eocene, Maryland, included in Aquia formation or stage, Clark and Martin, 140.

Pocono sandstone, Carboniferous, Maryland, Prosser, 631.

Poison Canyon formation, Eocene?, Colorado, Hills, 374.

Potapaco member or sub stage, Eocene, Maryland, included in Nanjemoy formation or stage, Clark and Martin, 140.

Potomac formation, Cretaceous, Atlantic coast region, Darton and Keith, 200.

Potosi limestone, Cambrian, Missouri, Keyes, 429.

Potosi limestone, Cambrian, Missouri, Nason, 561.

Potosi series, Cross, 177.

Potsdam formation, Cambrian, New York, Cushing, 185.

Pottawattamie formation, Carboniferous, Kansas, Rogers, 656.

Pottsville formation, Carboniferous, Maryland, Prosser, 631.

Pulaski formation, Eocene, Oregon, Diller, 281.

Quebec formation, Ordovician, Canada, Ami, 14.

Rattlesnake formation, Tertiary, Oregon, included in Pliocene, Merriam, 542.

Red Beds, Permian, Kansas, Gould, 297.

Red Rock sandstone, Carboniferous, Iowa, included in Des Moines formation, Miller, 548.

Richmond group, Ordovician, Kentucky and Tennessee, Foerste, 278.

Rochester shale, Silurian, New York, Grabau, 306.

Rogersville shale, Cambrian, Tennessee, Keith, 411.

Rome formation, Cambrian, Tennessee, Keith, 411.

Romney formation, Devonian, Maryland, Prosser, 631.

Rondout water lime, Silurian, New York, Grabau, 306.

Rockford limestone, Carboniferous, Indiana, Siebenthal, 709.

Rockwood formation, Silurian, Tennessee, Keith, 411.

Rutledge limestone, Cambrian, Tennessee, Keith, 411.

Sac limestone, Carboniferous, Missouri, Weller, 801.

St. John beds, Devonian, New Brunswick, Matthew, 535.

St. Joseph limestone, Cambrian, Missouri, Keyes, 429.

Geologic formations, description and synonymy—Continued.

St. Joseph limestones, Cambrian, Missouri, Nason, 561.

St. Kitts gravels, West Indies, Spencer, 722.

St. Louis, Carboniferous, Missouri, included in Mississippian series, Miller, 548.

Salem limestone, Carboniferous, Indiana, Cummings, 178.

Salina formation, Silurian, Maryland, Prosser, 631.

Salmon formation, pre-Cretaceous, California, Hershey, 362.

San Carlos formation, Pleistocene, Panama, Hershey, 365.

San gamon, Pleistocene, Iowa, Udden, 748.

San Juan formation, Colorado, Cross, 177.

Savanna sandstone, Carboniferous, Indian Territory, Taff, 736.

Saxicava sand, Canada, Coleman, 156.

Seaford limestone, West Indies, Spencer, 719.

Sellersburg beds, Devonian, Indiana, Kindle, 442.

Sellersburg limestone, Devonian, Indiana, Siebenthal, 709.

Seminole conglomerate, Carboniferous, Indian Territory, Taff, 736.

Senora formation, Carboniferous, Indian Territory, Taff, 736.

Sevier shale, Silurian, Tennessee, Keith, 411.

Sewell formation, Carboniferous, West Virginia, Campbell, 105.

Shasta-Chico series, Cretaceous, California, Lawson and Palache, 484a.

Shinarump, Triassic, Arizona, Ward, 777.

Sieston formation, California, Lawson and Palache, 484a.

Silver Creek limestone, Devonian, Indiana, Siebenthal, 709.

Silverton series, Colorado, Cross, 177.

Spearfish formation, Triassic, Black Hills, Darton, 198.

Stafford limestone, Devonian, New York, Clarke, 145.

Stafford limestone, Devonian, New York, Wood, 855.

Stewart shale, Carboniferous, Indian Territory, Taff, 736.

Stonehouse formation, Silurian, Canada, Ami, 22.

Stony Mountain formation, Ordovician, Canada, Dowling, 236.

Sunbury shale, Carboniferous, Ohio, Prosser, 629.

Sundance formation, Jurassic, Black Hills, Darton, 198.

Teay formation, Pleistocene, West Virginia, Campbell, 105.

Tellico sandstone, Silurian, Tennessee, Keith, 411.

Thompson Creek beds, included in White River beds, Tertiary, Montana, Douglass, 234a.

Thoroughfare volcanoes, Maine, Smith, 707.

Thurman sandstone, Carboniferous, Indian Territory, Taff, 736.

Geologic formations, description and synonymy—Continued.

Timpas formation, Cretaceous, Colorado, Hills, 374.
 Torio limestone, Panama, Hershey, 365.
 Toston beds, included in White River beds, Tertiary, Montana, Douglass, 234a.
 Traverse group, Devonian, Michigan, Grabau, 307.
 Trenton limestone, Ordovician, New Jersey, Kummel and Weller, 457.
 Trenton limestone, Ordovician, New Jersey, Weller, 805.
 Trinidad sandstone, Cretaceous, Colorado, Hills, 374.
 Tuscarora formation, Silurian, Maryland, Prosser, 631.
 Unkpapa sandstone, Jurassic, Black Hills, Darton, 198.
 Vinal Haven acid volcanoes, Maine, Smith, 707.
 Wapanucka limestone, Carboniferous, Indian Territory, Taff, 736.
 Washington serpentine marbles, Lyon, 506.
 Waverley series, Carboniferous, Ohio, Prosser, 629.
 Wellington formation, Permian, Oklahoma, Gould, 302.
 Wetumka shale, Carboniferous, Indian Territory, Taff, 736.
 Wewoka formation, Carboniferous, Indian Territory, Taff, 736.
 White River beds, included in Oligocene, includes Pipestone beds, Thompson Creek beds, Toston beds, and Black Tail Deer Creek beds, Tertiary, Montana, Douglass, 234a.
 White River group, Tertiary, Black Hills, Darton, 198.
 Winnipeg sandstone, Ordovician, Canada, Dowling, 236.
 Wisconsin, Pleistocene, Iowa, Macbride, 510.
 Woodstock member or substage, Eocene, Maryland, included in Nanjemoy formation or stage, Clark and Martin, 140.
 Yakima basalt, Miocene, Washington, Smith, 708.
 Yarmouth soil, Pleistocene, Iowa, Udden, 748.

Geologic maps.^a

Arkansas, Hayes, 356.
 Arkansas, Van Ingen, 762.
 California, Lawson and Palache, 484a.
 California, Nutter, 570.
 Canada, Ami, 20.
 Canada, Bell, 57.
 Canada, Coleman, 153.
 Canada, Daly, 190.
 Canada, Dowling, 236.
 Canada, Ells, 256.
 Canada, Tyrrell, 747.
 Canada, Willmott, 880.
 Colorado, Cross, 176.
 Colorado, Hills, 374.
 Colorado, Purington, 637.
 Colorado, Ransome, 639.
 Connecticut, Hobbs, 376.

Geologic maps—Continued.

District of Columbia, Darton and Keith, 200.
 Georgia, Hayes, 355.
 Georgia, Watson, 788.
 Idaho, Russell, 661.
 Indian Territory, Adams, 7.
 Indian Territory, Taff, 736.
 Indiana, Siebenthal, 701.
 Iowa, Calvin, 100.
 Iowa, McBride, 510.
 Iowa, Miller, 548.
 Iowa, Norton, 568.
 Iowa, Udden, 748, 749.
 Kansas, Adams, 7.
 Kansas, Gould, 301.
 Kansas, Americus limestone, Smith, 706.
 Louisiana, Adams, 7.
 Maine, Smith, 707.
 Maryland, Clark and Martin, 140.
 Maryland, Darton and Keith, 200.
 Maryland, Leonard, 491.
 Massachusetts, Burr, 97.
 Massachusetts, Clapp, 139.
 Massachusetts, Wilson, 838.
 Mexico, Ordofiez, 573.
 Michigan, Van Hise, 759.
 Minnesota, Hall, 382, 333.
 Minnesota, Van Hise, 759.
 Montana, Douglass, 234a.
 Nebraska, Gould, 301.
 New Jersey, Kummel, 455.
 New York, Bishop, 71.
 New York, Cushing, 185.
 New York, Grabau, 306.
 New York, Kemp and Hall, 421.
 New York, Smyth, 713.
 New York, Woodworth, 858.
 Oregon, Diller, 231.
 Panama, Hershey, 365.
 Pennsylvania, Peck, 590.
 South Dakota, Darton, 198.
 South Dakota, Jaggar, 402.
 Texas, Adams, 7.
 Virginia, Darton and Keith, 200.
 Washington, Smith, 708.
 Washington, Smith and Willis, 709.
 West Virginia, Campbell, 106.
 West Virginia, White, 815.
 Wisconsin, Buckley, 94.
 Wisconsin, Grant, 313.
 Wisconsin, Van Hise, 759.
 Wyoming, Darton, 198.
 Wyoming, Knight, 448.
 Wyoming, Knight and Slosson, 450.
 Wyoming, Loomis, 498.

Georgia.

Geologic relations of the iron ores in the Cartersville district, Hayes, 355.
 Geology of the Tallulah gorge, Jones, 406.
 Georgia bauxite deposits, Watson, 788.
 Granitic rocks of Georgia, Watson, 787.
 Origin of the phenocrysts in porphyritic granites, Watson, 789.
 Roads and road-building materials of Georgia, McCallie, 512.
 Shell Bluff, one of Lyell's original localities, Vaughan, 767.

^a Includes geologic maps of the whole or any part of the States mentioned.

Georgia—Continued.
 Trap dikes of Georgia, McCallie, 513.
 Vein structure at the Reynolds mine, Collins, 160.
 Weathering of granitic rocks, Watson, 791.

Glacial geology.
Alaska.
 Glacial phenomena of Seward Peninsula, Brooks and Collier, 81.

Appalachian region.
 Buried valley of Wyoming, Griffith, 328.

Canada.
 Ancient channels of Ottawa River, Ells, 260.
 Ancient drainage at Niagara Falls, Currie, 183.
 Glacial beds near Toronto, Coleman, 152.
 Marine and fresh water beaches, Coleman, 153.
 Observations on glaciers, Vaux, 770.
 Physical geology of central Ontario, Wilson, 839.
 Toronto and Scarboro drift series, Upham, 756.

Great Basin region.
 Extinct glaciers, Stone, 733.

Great Lakes region.
 Contributions to the problem of Niagara, Grabau, 308.
 Development of Wabash drainage system, McBeth, 508.
 Eskers and esker lakes of Indiana, Dryer, 248.
 Pre-glacial erosion in the course of the Niagara gorge, Upham, 753.
 Spy Run and Poinsett Lake bottoms, Price and Shaaf, 627.
 Western Indiana boulder belts, McBeth, 508.

Mississippi Valley region.
 Age of the Kansan drift sheet, Hershey, 364.
 Glacial lakes of Minnesota, Winchell, 843.

New England and New York.
 Geology and paleontology of Niagara Falls, Grabau, 306.
 Geology of central Cape Cod, Julien, 409.
 Geological history of Charles River, Clapp, 139.
 Glacial pot holes in Maine, Manning, 519.
 Medford dike area, Wilson, 838.
 Representatives of pre-Wisconsin till, Fuller, 288.

Ohio Valley.
 Extra-glacial abandoned valleys of Ohio basin, Campbell, 104.

Pacific coast region.
 Glacial work in the western mountains, Salisbury, 670.

Rocky Mountain region.
 Current notes on physiography, Davis, 216.
 Glacial work in the western mountains, Salisbury, 670.

General.
 De la progression des glaciers, leur stratification et leurs veines, Reid, 642.
 Ice ramparts, Buckley, 95.
 Mammals and reptiles, Rutland, 663.
 Moraines and maximum diurnal temperature, Todd, 743.
 Variations of glaciers, Reid, 643.

Greenland.
 Minerals from Narsarsuk, Flink, 277.

Hawaiian Islands.
 Brevity of tuff cone eruptions, Bishop, 61.

Hawaiian Islands—Continued.
 Structure of Diamond Head, Dall, 186.
 Tuff cone at Diamond Head, Hitchcock, 375.

Idaho.
 Border line between the Paleozoic and Mesozoic, Smith, 710.
 Geology and water resources of Nez Perce County, part I, Russell, 661.
 Geology and water resources of Nez Perce County, part II, Russell, 662.
 Idaho mining districts, Lakes, 477.
 Thunder Mountain, L'Hame, 488.

Indiana.
 Abandoned meanders of Spy Run Creek, Price and Shaaf, 628.
 Fluorspar mines of Kentucky and Illinois, Burk, 96.
 Contributions to Indiana paleontology, Greene, 319, 320, and 321.
 Development of Wabash drainage system, McBeth, 508.
 Developmental stages of Orthothetes minutus, Cumings, 182.
 Devonian fossils and stratigraphy of Indiana, Keyes, 442.
 Eskers and esker lakes in Indiana, Dryer, 248.
 Evidence of local subsidence, Campbell, 103.
 Lakes of Indiana and their marl deposits, Blatchley and Ashley, 69.
 New crinoid from the Hamilton, Wood, 856.
 New species of algae, White, 809a.
 Observations in Indiana caves, Farrington, 271.
 Oolitic stone for Portland cement, Blatchley, 67.
 Ordovician rocks of southern Indiana, Cumings, 181.
 Orthothetes minutus n. sp. from the Salem limestone, Cumings, 179.
 Petroleum industry in 1900, Blatchley, 68.
 River beds and bluffs, Heiney, 360.
 Silver Creek hydraulic limestone, Siebenthal, 701.
 Spy Run and Poinsett Lake bottoms, Price and Shaaf, 627.
 Upper Ordovician at Vevay, Cumings, 180.
 Western Indiana boulder belts, McBeth, 509.

Indian Territory.
 Coalgate folio, Taff, 736.
 Geology of Seminole Creek, Cherokee and Osage nations, Gould, 298.
 Oil and gas fields of western interior and Gulf coast, Adams, 7.
 Ouachita and Arbuckle Mountain sections, Taff, 735.

Iowa.
 Geology of Cedar County, Norton, 568.
 Geology of Clay and O'Brien counties, Macbride, 510.
 Geology of Louisa County, Udden, 748.
 Geology of Marion County, Miller, 648.
 Geology of Page County, Iowa, Calvin, 100.
 Geology of Pottawattamie County, Udden, 749.
 Kinderhook faunal studies, Weller, 804.
 Loess of Iowa City, Shimek, 697.

Iowa—Continued.

Occurrence of gold and other mineral products in Iowa, Calvin, 101.
Old channels of the Mississippi, Leverett, 494.

Jura.*New England.*

Newark system of the Pomperaug Valley, Hobbs, 376.

Rocky Mountain region.

Dinosaur beds of the Grand River Valley, Riggs, 650.
Geology of Black Hills, Darton, 198.
Jurassic stratigraphy in Wyoming, Loomis, 498.
La Plata folio, Cross, 176.
Morrison formation, Lee, 487.
Triassic and Jurassic strata of the Black Hills, Hovey, 395.

Kansas.

Age of Red Beds, Adams, 6.
Age of the Red Beds, Beede, 56.
Americus limestone, Smith, 706.
Concretions of Ottawa County, Bell, 59.
Dakota Cretaceous of Kansas and Nebraska, Gould, 301.
Dakota sandstone in Washington County, Charles, 133.
Flint hills of Kansas, Mead, 540.
Fossils from the Red Beds, Gould, 297.
Fossil plants in the Permian, Sellards, 689.
Galena-Joplin lead and zinc district, Haworth, 350.
High plains and their utilization, Johnson, 404.
Kansas coal mining, Crane, 168.
Kansas mines and minerals, Grimsley 329.
Kansas-Oklahoma-Texasgypsum hills, Gould, 300.
New turtle from the Kansas Cretaceous, Williston, 887.
Oil and gas fields of western interior and Gulf coasts, Adams, 7.
Petroleum and natural gas, Haworth, 351.
Pottawattamie and Douglas formations, Rogers, 656.
Southern extension of the Marion and Wellington formations, Gould, 302.
Tetiopteris of the Permian, Sellards, 688.
Tertiary springs of Kansas and Oklahoma, Gould, 299.

Kentucky.

Fluorspar mines of Kentucky and Illinois, Burk, 96.
Silurian and Devonian limestone, Foerste, 278.

Maine.

Andesites of the Aroostook volcanic area, Gregory, 322.
Composition and occurrence of pollucite, Wells, 809.
Geological study of the Fox Islands, Smith, 707.
Glacial pot holes in Maine, Manning, 519.
Minerals at Haddam, Martin, 520.
Shells of the marl deposits of Aroostook County, Nylander, 571.

Maryland.

Basic rocks of northeastern Maryland, Leonard, 491.
Eocene arthropoda, Ulrich, 750.
Eocene bryozoa, Ulrich, 751.
Eocene coelenterata, Vaughan, 765.
Eocene deposits of Maryland, Clark and Martin, 140.
Eocene echinodermata, Clark and Martin, 143.
Eocene mollusca, Clark and Martin, 141.
Eocene molluscoidea (brachiopoda), Clark and Martin, 142.
Eocene pisces, Eastman, 251.
Eocene plantae, Hollick, 387.
Eocene protozoa, Bagg, 35.
Names for the formations of the Ohio coal measures, Prosser, 632.
Occurrence of zoisite and thulite, Bibbins, 70.
Paleozoic Appalachia, Willis, 831.
Paleozoic formations of Allegany County, Prosser, 631.

Physiographic features, Abbe, 1.
Systematic paleontology, Eocene reptilia, Case, 120.
Washington folio, Darton and Keith, 200.

Massachusetts.

Amygdaloidal melaphyres of the Boston basin, Crosby, 173.
Concretions from the Champlain clays, Sheldon, 695.
Geological history of Charles River, Clapp, 139.
Geology of central Cape Cod, Julien, 409.
Lead and silver mines, Newbury, Hovey, 397.
Medford dike area, Wilson, 838.
Micaceous cross-banding of strata, Woodworth, 857.
Reconnaissance of the Elizabeth Islands, Hollick, 385.
Representatives of pre-Wisconsin till, Fuller, 288.
Structural relations of amygdaloidal melaphyre, Burr, 97.

Mexico.

Cretaceous of Obispo Canyon, Dumble, 245.
Distribucion geográfica y geológica de los criaderos minerales, Aguilera, 8.
Ein Profil durch den Ostabfall der Sierra Madre Oriental, Böse, 72.
Geographic and geologic features of Mexico, Hall, 373.
La industria minera, Ordoñez, 574.
Las rhyolitas, Ordoñez, 573.
Mining industry of Pachuca, Ordonez, 575.
Mining in Lower California, Lowry, 500.
Oyster shells in volcanic deposits, Dumble, 246.
Sierra Mojada and its ore deposits, Malcolmson, 518.
Silver-bearing veins of Mexico, Halse, 335.

Michigan.

Geologic section in Alpena and Presque Isle counties, Grabau, 307.
Iron-ore deposits of the Lake Superior region, Van Hise, 759.

Michigan—Continued.

Meteorite from Allegan, Michigan, and Mart, Texas, Merrill and Stokes, 546.
Michigan limestones, Lane, 480.
Preglacial surface deposits, Lane, 481.

Mineralogy.

A large phlogopite crystal, McNairn, 517.
Bastnasite and tysonite, Allen and Comstock, 11.
Chemical composition of amblygonite, Penfield, 594.
Chemical composition of childrenite, Penfield, 593.
Chemical composition of durangite, Brush, 87.
Chemical composition of hamlinite and its occurrence with bertrandite, Penfield, 597.
Composition and occurrence of pollucite, Wells, 809.
Constituents of meteorites, Farrington, 269.
Contribution to mineralogy of California, Blasdale, 66.
Des progrès de la production des pierres précieuses aux Etats-Unis, Kunz, 458.
Description of new species from Branchville, Brush and Dana, 88.
Economic geology of the Silverton quadrangle, Ransome, 639.
Fifth Branchville paper, Brush and Dana, 92.
Iron of meteoric origin, Pratt, 621.
Mart and Bluff meteorites, Charlton, 134.
Metallic veins of Farmington meteorite, Farrington, 267.
Metasomatic processes in fissure veins, Lindgren, 495.
Meteorite from Allegan, Michigan, and Mart, Texas, Merrill and Stokes, 546.
Meteorite which fell near Felix, Alabama, Merrill, 543a.
Meteorites of Nebraska, Barbour, 41.
Mineralogical notes, Eakle, 250.
Mineralogical notes, Chester, 136.
Mineralogical notes, Moses, 558.
Mineralogical notes, Rogers, 655.
Minerals associated with copper, Stone, 732.
Minerals at Haddam, Martin, 520.
Minerals in gold quartz veins, Lindgren, 497.
Minerals from Narsarsuk, Flink, 277.
Minerals of Nova Scotia, Gilpin, 294.
Mode of occurrence of albertite, Bailey, 36.
Mohawkite, Richards, 645.
New minerals from Franklin, New Jersey, Penfield and Warren, 603.
New mineral occurrences in Canada, Hoffmann, 381.
New minerals in Canada, Hoffmann, 382.
Note on certain copper minerals, Winchell, 842.
Occurrence of thaumasite, Penfield and Pratt, 602.
Occurrence of zoisite and thulite, Bibbins, 70.
Octahedrite and brookite, Robinson, 654.
On bixbyite, Penfield and Foote, 598.
On calaverite, Penfield and Foote, 600.
On clinohedrite, Penfield and Foote, 599.
On gahnite, Brush, 86.
On hortonolite, Brush, 84.
On mordenite, Pirsson, 615.

Mineralogy—Continued.

On northupite, pirssonite, etc., Pratt, 623.
On pearceite, Penfield, 596.
On spangolite, Penfield, 595.
On sussextite, Brush, 85.
On wellsite, Pratt and Foote, 624.
Pre-terrestrial history of meteorites, Farrington, 270.
Progress of mineralogy in 1899, Hamilton and Withrow, 337.
Pyrite and marcasite, Stokes, 729.
Report of section of chemistry and mineralogy, Hoffmann, 380.
Second Branchville paper, Brush and Dana, 89.
Serpentines of Manhattan Island, Newland, 565.
Sperrylite, Wells, 808.
Spodumene, and results of its alteration, Brush and Dana, 91.
Structure of meteorites, Farrington, 268.
The nonmetallic minerals, U. S. National Museum, Merrill, 545.
Third Branchville paper, Brush and Dana, 90.
Ward-Coonley collection of meteorites, Gratacap, 317.

Minerals described.

Albertite, Bailey, 36.
Altaite, Eakle, 250.
Arsenopyrite, Chester, 136.
Atacamite, Moses, 558.
Barite, Rogers, 655.
Bastnasite, Allen and Comstock, 11.
Bixbyite, Penfield and Foote, 598.
Bornite, Winchell, 842.
Brookite, Robinson, 654.
Calaverite, Penfield and Foote, 600.
Calcite, Rogers, 655.
Calcite strontium, Chester, 136.
Caledonite, Rogers, 655.
Celestite, Rogers, 655.
Chalcopyrite, Winchell, 842.
Chlorite, Blasdale, 66.
Chrysoberyl, Moses, 558.
Clinohedrite, Penfield and Foote, 599.
Coquimbite, Eakle, 250.
Corundum, Pratt, 622.
Cymatolite, Brush and Dana, 91.
Danalite, Hoffmann, 381.
Datolite, Eakle, 250.
Datolite, Hoffmann, 382.
Deweylite, Chester, 136.
Diallage, Blasdale, 66.
Diamond, Hobbs, 378.
Dickinsonite, Brush and Dana, 88, 92.
Durangite, Brush, 87.
Eosophorite, Brush and Dana, 88, 90.
Esmeraldaita, Eakle, 250.
Fairfieldite, Brush and Dana, 89, 92.
Faujasite, Hoffmann, 382.
Filowite, Brush and Dana, 89, 92.
Gahnite, Brush, 86.
Galena, Rogers, 655.
Glaucocroite, Penfield and Warren, 603.
Hamlinite, Penfield, 597.
Hancockite, Penfield and Warren, 503.
Hanksite, Pratt, 623.

Minerals described—Continued.

Hornblende, Blasdale, 66.
 Hortonolite, Brush, 84.
 Ilmenite, Chester, 136.
 Leadhillite, Rogers, 655.
 Ledouxite, Richards, 645.
 Lepidolite, Hoffmann, 381.
 Leucophoenite, Penfield and Warren, 603.
 Linarite, Rogers, 655.
 Lithiophilite, Brush and Dana, 88, 90.
 Marcasite, Chester, 136.
 Marcasite, Stokes, 729.
 Meteoric iron, Pratt, 621.
 Meteorite, Barbour, 41.
 Meteorite, Charlton, 134, 136.
 Meteorite, Farrington, 267, 268, 269, 270.
 Meteorite, Merrill, 544a.
 Meteorite, Merrill and Stokes, 546.
 Mohawkite, Richards, 645.
 Mordenite, Pirsson, 615.
 Nasonite, Penfield and Warren, 603.
 Natron, Hoffmann, 380.
 Natrophilite, Brush and Dana, 92.
 Newberryite, Hoffmann, 381.
 Northupite, Pratt, 623.
 Octahedrite, Robinson, 664.
 Pearcecite, Penfield, 596.
 Pectolite, Eakle, 250.
 Pectolite, Moses, 558.
 Phlogopite, McNairn, 517.
 Pirsonite, Pratt, 623.
 Pollucite, Wells, 809.
 Pureaulite, Brush and Dana, 92.
 Pyrite, Rogers, 655.
 Pyrite, Stokes, 729.
 Pyroxene, Moses, 558.
 Realgar, Moses, 558.
 Reddingite, Brush and Dana, 89, 92.
 Roscoelite, Lindgren, 497.
 Schorlomite, Hoffmann, 381.
 Spangolite, Penfield, 595.
 Sperrylite, Wells, 808.
 Spodumene, Brush and Dana, 91.
 Spodumene, Hoffmann, 381.
 Struvite, Hoffmann, 381.
 Sussexitite, Brush, 85.
 Tetrahedrite, Chester, 136.
 Topaz, Rogers, 655.
 Tremolite, Blasdale, 66.
 Triploidite, Brush and Dana, 88.
 Tysonite, Allen and Comstock, 11.
 Uranophane, Hoffmann, 381.
 Vermiculite, Chester, 136.
 Vesuvianite, Moses, 558.
 Wellsite, Pratt and Foote, 624.
 Zircon, Eakle, 250.

Minnesota.

Constituents of Minnesota soils, Hall, 331.
 Glacial lakes of Minnesota, Winchell, 843.
 Keewatin area of eastern and central Minnesota, Hall, 333.
 Keeweenawan area of eastern Minnesota, Hall, 332.
 Iron-ore deposits of the Lake Superior region, Van Hise, 759.
 Lower Silurian fauna of Minnesota, Sardeson, 677.

Minnesota—Continued.

Lower Silurian formations of Wisconsin and Minnesota, Sardeson, 676.
 Paleozoic fossils in the drift, Sardeson, 675.

Mississippi.

Historical outline of the geological and agricultural survey of the State of Mississippi, Hilgard, 368.

Missouri.

Age of the Kansan drift sheet, Hershey, 364.
 Cambrian fossils of St. François County, Beecher, 52.
 Correlation of the Kinderhook formations, Weller, 801.
 Eurypterid remains in the Cambrian, Beecher, 53.
 Fossils from the Upper Paleozoic rocks, Rowley, 658.
 Galena-Joplin lead and zinc district, Horth, 350.
 Geological Surveys in Missouri, Broadhead, 78.
 Geology and mineralogy, Broadhead, 79.
 Limestone conglomerate in the lead region, Nason, 560.
 Nomenclature of the Cambrian formations of the St. François Mountains, Keyes, 429.
 Origin of Joplin ore deposits, Bain, 38.
 Relations and age of the St. Joseph and Potosi limestones, Nason, 561.

Montana.

Fossil mammalia of White River beds, Douglass, 234a.
 Missourite, a new leucite rock, Weed and Pirson, 799.
 New species of *Merycochoerus*, Douglass, 234.
 Note on certain copper minerals, Winchell, 842.
 Oil of the northern Rocky Mountains, Willis, 884.
 Petrography of Square Butte, Pirson, 616.
 Petrography of Yogo Peak, Pirson, 617.
 Shonkin Sag and Palisade Butte laccoliths in the Highwood Mountains, Weed and Pirson, 798.

Nebraska.

Concretions of the Pierre shale, Barbour, 40.
 Dakota and Carboniferous clays of Nebraska, Gould and Fisher, 305
 Dakota Cretaceous of Kansas and Nebraska, Gould, 301
 Fauna of the Permian, Beede, 55.
 Meteorites of Nebraska, Barbour, 41.
 Report of State Geological Survey, Barbour, 42.
 Value of bluff and valley wash deposits as brick material, Fisher, 273.

Nevada.

A new fossil cyprinoid, *Leuciscus turneri*, Lucas, 504.
 Geology of the Great Basin, Turner, 744.
 Mines of Esmeralda County, Turner, 746.
 Notes on two desert mines, Emmons, 262.
 Occurrence of tungsten ore, Weeks, 800.
 Pyramid Lake, Fairbanks, 264.
 Santa Fe mining district, McCormick, 515.
 Tonopah, Knapp, 444.
 Variations of texture in Tertiary igneous rocks of the Great Basin, Spurr, 724.

Newfoundland.

Preliminary notice of Etcheminian fauna, Matthew, 529.

New Hampshire.

Albany granite and its contact phenomena, Hawes, 349. Composition of labradorite rocks, Dana, 192. Eruptive rocks in Campton, Hawes, 348. Rocks of Lake Winnepesaukee, Washington, 785.

New Jersey.

Administrative report, New Jersey Geological Survey, Smock, 712. Artesian wells, Woolman, 859. Atlantic City's deep artesian well, Carter, 119. Camden's artesian water supply, Carter, 116. Crustacea of the Cretaceous, Pilsbry, 613. Erosion of shore line at Atlantic City, Carter, 118. Mineralogical notes, Chester, 136. Mining industry, Kummel, 466. New minerals from Franklin, Penfield and Warren, 603. Occurrence of thaumasite, Penfield and Pratt, 602. On clinohedrite, Penfield and Foote, 599. On gahnite, Brush, 86. On sussextite, Brush, 85. Paleozoic limestones of Kittatinny Valley, Kummel and Weller, 457. Paleozoic rocks of northwestern New Jersey, Van Ingen, 764. Portland cement industry, Kummel, 455. Preliminary report on the Paleozoic formations, Weller, 805. Serpentines of Manhattan Island, Newland, 565.

New Mexico.

A new coal field, Lakes, 466. Cerrillos anthracite mine, Lakes, 465. Curtis mines, Lakes, 467. Extinct glaciers, Stone, 733. Geology of the saline basins of central New Mexico, Johnson, 403. Minerals associated with copper, Stone, 732. Mogollon range, Weatherby, 793.

New York.

Adirondack augite-andesite, Cushing, 184. Beach structure in Medina sandstone, Fairchild, 265. Cambro-Ordovician outlier at Wellstown, Julien, 410. Cambro-Ordovician outlier at Wellstown, Kemp, 414. Discovery of a mastodon's tooth and the remains of a boreal vegetation on Staten Island, Hollick, 386. Emery deposits of Westchester County, Eakle, 254. Emery mines of Westchester County, Nevins, 564. Faunas of the Ordovician at Glens Falls, White, 818. Fort Cassin beds in the Calciferous limestone, Dwight, 249. Geologic notes on the neighborhood of Buffalo, Martin, 521.

New York—Continued.

Geology and paleontology of Niagara Falls, Grabau, 306. Geology of crystalline rocks, Smyth, 713. Geology of Rand Hill, Cushing, 185. Hematite iron ores of Antwerp and Fowler belt, Crosby, 175. Hudson River beds near Albany, Ruedemann, 659. Limestones interbedded with shales of Marcellus stage, Clarke, 145. List of mammals of New York, Miller, 549. Marcellus limestone, Wood, 855. New Agelacrinites, Clarke, 146. Oil and gas in New York, Bishop, 71. On hortonolite, Brush, 84. Ontario coast, Martin, 526. Oriskany fauna and Becroft Mountain, Clarke, 144. Petroleum and natural gas, Orton, 577. Physiography of Lake George, Kemp, 417, 420. Pleistocene geology of Nassau County, Woodworth, 858. Pre-Cambrian formations, Kemp and Hall, 421. Post-Pliocene fossils of the Niagara River gravels, Letson, 493. Reef structures in the Clinton and Niagara strata, Sarle, 678. Serpentines of Manhattan Island, Newland, 565. Slate quarries of Washington County, Nevins, 563. Trenton conglomerate of Rhysedorph Hill, Ruedemann, 660.

Nicaragua.

Recent decline in the level of Lake Nicaragua, Shimek, 696.

North Carolina.

Carolina gold deposits, Weed, 796. Copper deposits of southern United States, Weed, 795. Corundum in North Carolina, Ropes, 657. Iron of meteoric origin, Pratt, 621. Oyster reefs of North Carolina, Grave, 318. Octahedrite and brookite, Robinson, 654.

North Dakota.

Lignite deposits, Haseltine, 341. Report of Geological Survey, Babcock, 34.

Ohio.

Arthrodires from the Cleveland shale, Dean, 227. Classification of the Waverley series, Prosser, 629. Cleveland water-supply tunnel, Pierce, 612. Names for the formations of the Ohio Coal Measures, Prosser, 632. Pre-Glacial drainage in southwestern Ohio, Miller, 547. Use of the term Bedford limestone, Prosser, 630.

Oklahoma.

Age of Red Beds, Adams, 6. Age of the Red Beds, Beede, 56. Fossils from the Red Beds, Gould, 297. Geology of Seminole, Creek, Cherokee, and Osage nations, Gould, 298.

Oklahoma—Continued.

Geology of the Glass Mountains, White, 817.
 Kansas-Oklahoma-Texas gypsum hills, Gould, 300.
 Oklahoma limestones, Gould, 304.
 Oklahoma salt plains, Gould, 303.
 Ouachita and Arbuckle Mountain sections, Taft, 735.
 Southern extension of the Marion and Wellington formations, Gould, 802.
 Springs of Kansas and Oklahoma, Gould, 299.

Oregon.

Coo Bay folio, Diller, 231.
 Cretaceous fossils from John Day Basin, Stanton, 725.
 Fossil land shells of the John Day Basin, Stearns, 727.
 Geological section through John Day Basin, Merriam, 542.
 Geology of the John Day Basin, Merriam, 542.
 Geology of the Three Sisters, Fairbanks, 268.
 Minerals in gold quartz veins, Lindgren, 497.
 New fossil tapir in Oregon, Sinclair, 703.
 Oregon nickel prospects, Ledoux, 486.
 Report on the Clarno flora, Knowlton, 452.
 Report on the flora of the Mascall formation, Knowlton, 453.
 Trias in northeastern Oregon, Lindgren, 496.

Paleontology.*Algonkian:*

Sur les formations précambriniennes fossilifères, Walcott, 774.

Cambrian:

Acrothrya and Hyolithes, Matthew, 531.
 Cambrian brachiopoda, Walcott, 771.
 Cambrian fossils of St. François County, Beecher, 52.
 Eurypterid remains in the Cambrian, Beecher, 53.
 Hyolithes gracilis, Matthew, 532.
 Les plus anciennes faunes Paléozoïques, Matthew, 536.
 New species of Olenellus, Wanner, 776.
 Paleozoic rocks of northwestern New Jersey, Van Ingen, 764.
 Preliminary notice of Etcheminian fauna, Matthew, 529.

Carboniferous:

Border line between the Paleozoic and Mesozoic, Smith, 710.
 Contributions to Indian paleontology, Greene, 320, 321.
 Correlation of the Kinderhook formations, Weller, 801.
 Developmental stages of Orthothetes minutus, Cumings, 182.
 Fauna of the Permian, Beebe, 55.
 Fossils from the Red Beds, Gould, 297.
 Fossils from the Upper Paleozoic rocks, Rowley, 658.
 Fossil plants in the Permian, Sellards, 689.
 Kinderhook faunal studies, Weller, 804.
 Orthothetes minutus n. sp., from the Salem limestone, Cumings, 179.
 Paleobotanical aspects of the Upper Paleozoic, White, 814.
 Permo-Carboniferous sharks, Eastman, 252.

Paleontology—Continued.

Carboniferous—Continued.
 Possible new coal plants, Gresley, 327.
 Pottawattamie and Douglas formations, Rogers, 656.
 Prodromites. A new ammonite genus, Smith and Weller, 711.
 Tæniopteris of the Permian, Sellards, 688.
 Whittleseya and their systematic relations, White, 813.

Cretaceous:

A new dinosaur, Stegosaurus marshi, Lucas, 502.
 Chondrodonta, Stanton, 728.
 Cretaceous fossils from the John Day Basin, Stanton, 725.
 Crustacea of the Cretaceous, Pillsbury, 613.
 Dakota Cretaceous of Kansas and Nebraska, Gould, 301.
 Dinosaurian genus Creosaurus Marsh, Williston, 836.
 Geology of the John Day Basin, Merriam, 542.
 Lytoceras from the Cretaceous rocks, Whiteaves, 820.
 New species of Unio, Whiteaves, 819.
 New turtle from the Kansas Cretaceous, Williston, 837.
 Teleosts from the Cretaceous, Cragin, 167.

Devonian.

Amnigenia as an indicator of fresh-water deposits, Clarke, 147.
 A new geological formation in the Devonian, Ami, 16.
 Are the St. John plant beds Carboniferous? Matthew, 535.
 Arthrodires from the Cleveland shale, Dean, 227.
 Contributions to Indiana paleontology, Greene, 320, 321.
 Devonian fossils and stratigraphy of Indiana, Keyes, 412.
 Helderbergian fossils near Montreal, Schuchert, 682.
 Knoydart formation of Nova Scotia, Ami, 20.
 Limestones interbedded with shales of Marcellus stage, Clarke, 145.
 Marcellus limestone, Wood, 855.
 New Agelacrinites, Clarke, 146.
 New crinoid from the Hamilton, Wood, 855.
 Opening address, geologic section, Grant, 310.
 Paleozoic rocks of northwestern New Jersey, Van Ingen, 764.

Silurian and Devonian limestone, Foerste, 278.
 Silver Creek hydraulic limestone, Siebenthal, 701.

Jurassic.

Dinosaur beds of the Grand River Valley, Riggs, 650.
 Fossil wood from the Newark formation, Knowlton, 454.
 Jura-fossilien aus Alaska, Pompeckj, 620.
 Jurassic dinosaur deposits near Canyon City, Hatcher, 345.
 Morrison formation, Lee, 487.

Pleistocene.
 A new Californian Bittium, Dall and Bartsch, 189.

Paleontology—Continued.**Pleistocene—Continued.**

Geology of Pottawattamie County, Iowa, Udden, 749.
Geology of the Philippine islands, Becker, 50.
Loess of Iowa City, Shimek, 697.
Post-Pliocene fossils of the Niagara River gravels, Letson, 493.
Sea beaches of eastern Ontario, Coleman, 156.

Silurian.

Contributions to Indiana paleontology, Greene, 319 and 321.
Fort Cassin beds in the Calciferous limestone, Dwight, 249.
Fossils in the Saint Peter sandstone, Sardeson, 674.
Geology and paleontology of Niagara Falls, Grabau, 306.
Geology of west shore of Lake Winnipeg, Dowling, 236.
Hudson River beds near Albany, Ruedemann, 659.
Lower Silurian fauna of Minnesota, Sardeson, 677.
New species of algae, White, 809a.
Opening address, geologic section, Grant, 310.
Ordovician rocks of southern Indiana, Cummings, 181.
Paleozoic rocks of northwestern New Jersey, Van Ingen, 764.
Silurian and Devonian limestone, Foerste, 278.
Siluric fauna near Batesville, Arkansas, Van Ingen, 768.
Trenton conglomerate of Rhysedorph hill, Ruedemann, 660.

Tertiary.

A flightless auk, *Mancala californiensis*, Lucas, 504a.
A new fossil cyprinoid, *Leuciscus turneri*, Lucas, 504.
A new rhinoceros, *Trigonias osborni*, Lucas, 501.
Eocene arthropoda, Ulrich, 750.
Eocene bryozoa, Ulrich, 751.
Eocene coelenterata, Vaughan, 765.
Eocene deposits of Maryland, Clark and Martin, 140.
Eocene echinodermata, Clark and Martin, 143.
Eocene mollusca, Clark and Martin, 141.
Eocene molluscoidea (Brachiopoda), Clark and Martin, 142.
Eocene pisces, Eastman, 251.
Eocene plantae, Hollick, 387.
Eocene protozoa, Bagg, 35.
Eocene reptilia, Case, 120.
Correlation des horizons de mammifères Tertiaires en Europe et en Amérique, Osborn, 588.
Fossils corals from the elevated reefs of Curaçao, Aruba, and Bonaire, Vaughan, 766.
Fossil land shells of the John Day basin, Stearns, 727.
Geological and physical development of Aguilla, St. Martin, St. Bartholomew, and Sombrero, Spencer, 721.
Geology of the John Day basin, Merriam, 542.

Paleontology—Continued.**Tertiary—Continued.**

Gigantic fossil *Lucina*, Dall, 188.
New fossil tapir in Oregon, Sinclair, 703.
New American species of *Amphicyon*, Wortman, 860.
New species of *Merycochcerus*, Douglas, 234.
North American species of the genus *Equus*, Gidley, 282.

Pelvic girdle of *Zeuglodon Basilosaurus cetoides* (Owen), Lucas, 502.
Report on the Clarno flora, Knowlton, 452.
Report on the flora of the Macall formation, Knowlton, 453.

Sabal rigida, Hatcher, 344.
Shell Bluff, one of Lyell's original localities, Vaughan, 767.

Studies of Eocene mammalia in the Marsh collection, Wortman, 861, 862, 863, 864, 865.
Texas oil well fossil, Alderson, 10.

Triassic.

Border line between the Paleozoic and Mesozoic, Smith, 710.
Fossils from the Red Beds, Gould, 297.
Vertebrates from the Trias of Arizona, Lucas, 505.

General.

American fossil cycads, Wieland, 824.
Ancient American saurians, Beard, 49.
Catalogue of types and figured specimens in the collection of the American Museum of Natural History, Whitfield, 822.
Characteristic types of American dinosaurs, Beard, 48.
Characters of *Mylostoma* Newberry, Dean, 228.
Chronological distribution of the Elasmobranchs, Hay, 353.
Cranial elements and dentations of *Titanothereum*, Hatcher, 343.
Des méthodes précises mises actuellement en œuvre dans l'étude des vertébrés fossiles des Etats-Unis d'Amérique, Osborn, 582.
Diplodocus Marsh, Hatcher, 342.
Fore and hind limbs of the sauropoda, Osborn and Granger, 585.
Foreleg and pectoral girdle of *Morosaurus*, Riggs, 651.
Fossil fresh-water shells of Colorado Desert, Stearns, 727a.
Fossils and their teachings, Heilprin, 358.
Genera and species of Canadian Paleozoic corals, Lambe, 479.
Helicoceras stevensoni, Whitfield, 823.
Largest known dinosaur, Riggs, 652.
List of mammals of New York, Miller, 549.
Mammals and reptiles, Rutland, 663.
Missing links, Montgomery, 556.
Morphology of the hinge teeth of bivalves, Dall, 187.
New and little-known fossil vertebrates, Hatcher, 346.
North American paleobotany, 1890-1900, Penhallow, 605.
North American species of *Dadoxylon*, Penhallow, 604.
Observations on the Creodonts, Matthew, 583.

Paleontology—Continued.

General—Continued.

- Origin of the Antarctic faunas and floras, Ortmann, 576.
- Origin of the mammals, Kingsley, 443.
- Paleontological speculations, Gratacap, 315 and 316.
- Phylogeny of the primates, Brown, 83.
- Problem of the Monticuliporoidea I, Sardeson, 671.
- Problem of the Monticuliporoidea, II, Sardeson, 672.
- Progress of vertebrate paleontology in America, Osborn, 578.
- Recent zoopalaeontology, Osborn, 579 and 581.
- Reef structures in the Clinton and Niagara strata, Sarle, 678.
- Relationships of the Arthrogymnathi, Dean, 229.
- Revision of American Eocene primates and of the Myxodectidae, Osborn, 584.
- Review of recent papers on Bahaman corals, Vaughan, 768.
- Shells of the marl deposits of Aroostook County, Maine, Nylander, 571.
- Structure of the manus in *Brontosaurus*, 347.
- Studies in evolution, Beecher, 51.
- Studies in fossil botany, Scott, 683.

Genera and species described.

- Acidaspis obsoleta* n. sp., van Ingen, 763.
- quinquespinnosa* Salter-Lake, van Ingen, 763.
- Acrocrinus casedayi* Lyon, Rowley, Greene, 320.
- casedayi* var. *charlestowensis*, n. var. (Rowley), Greene, 320.
- depressus* n. sp. (Rowley), Greene, 320.
- wachmuthii* n. sp., Rowley, 658.
- Acrophyllum regosum* n. sp., Greene, 319.
- Acrothele avia* n. sp., Matthew, 530.
- proavia* n. sp., Matthew, 530.
- Actinopteria boydi* (Conrad), Kindle, 442.
- Aechmine* Jones and Holl, Grabau, 306.
- spinosa* (Hall), Grabau, 306.
- Aeluthorium bicuspidum* n. sp., Wortman 863.
- latidens* Marsh, Wortman, 863.
- Actobatis* Muller and Henle, Case, 251.
- arcuatus* Agassiz, Case, 251.
- Agaricia* Lamarck 1801, Vaughan, 766.
- agaricites* (Linnaeus), Vaughan, 766.
- fragilis* (Dana), Vaughan, 766.
- Agelacrinites* beecheri n. sp., Clarke, 146.
- buttsi* n. sp., Clarke, 146.
- Agoniatitites* expansus, Clarke, 145.
- Agriochoerus maximus* n. sp., Douglass, 284a.
- minimus* n. sp., Douglass, 284a.
- Alasmidonta* Say, Letson, 493.
- calceola* (Lea) Simpson, Letson, 493.
- truncata* (Wright) Simpson, Letson, 493.
- Alisina barnetti* n. sp., Kindle, 442.
- barnetti* var. *elongata* n. var., Kindle, 442.
- Alveoporo regularis* Duncan, Vaughan, 766.
- Amboeoelia* nana Grabau, Wood, 855.
- umbonata* (Conrad), Kindle, 442.
- Ammonitella yatesi* praecursor, Stanton, 727.
- Amnicola* Gould and Haldeman, Letson, 493.
- letoni* Walker, Letson, 493.
- limosa* (Say) Hald., Letson, 493.

Paleontology—Continued.

Genera and species described—Continued.

- Amnicola protia* Gould, Stearns, 727a.
- Amnigenia catskillensis* Vanuxem sp., Clarke, 147.
- Amphicyon americanus*, Wortman, 860.
- Amphistegina lessonii* d'Orbigny, Bagg, 35.
- Amplexopora multispinosa* n. sp., Cummings, 180.
- Amplexus radigerus* n. sp., Rowley, 658.
- vermicularis* n. sp., Rowley, 658.
- Amphyx niagarensis* n. sp., van Ingen, 763.
- (*Lonchodusmas*) *hastatus* n. sp., Ruedemann, 660.
- Anastrophia* Hall, Grabau, 306.
- brevirostris* Hall, Grabau, 306.
- internascens* Hall 1879, Beecher, 51.
- interplicata* (Hall), Grabau, 306.
- Anoloticha impolita* Ulr., Sardeson, 671.
- Anomalina ammonoides* (Reuss), Bagg, 35.
- grosserugosa* (Gumbel), Bagg, 35.
- Anomia marylandica* n. sp., Clark and Martin, 141.
- mcgeeii* Clark, Clark and Martin, 141.
- Anoplotheca* Sandberger, Grabau, 306.
- hemispherica* (Sowerby), Grabau, 306.
- plicatula* (Hall), Grabau, 306.
- Aparchites minutissimus* var. *robustus* n. var., Ruedemann, 660.
- Aporrhais potomacensis* n. sp., Clark and Martin, 141.
- Aptychopsis terranovicus*, Matthew, 529.
- Ascaricarboxylon prosseri* n. sp., Penhallow, 604.
- virginianum*, Knowlton, 454.
- Arges arkansas* n. sp., van Ingen, 763.
- phylictenoides* (Green) 1837, van Ingen, 763.
- sp., van Ingen, 763.
- Arretotherium acridens* n. gen. et sp., Douglass, 234a.
- Arthroclema armatum* Ulr., Sardeson, 672.
- Arthropycus* Hall, Grabau, 306.
- harlani* (Conrad), Grabau, 306.
- Astarte marylandica* Clark, Clark and Martin, 141.
- Athyris crassicardinalis* White, Weller, 804.
- fultonensis* (Swallow), Kindle, 442.
- spiriferoides* (Eaton), Kindle, 442.
- Atrypa* Dalman, Grabau, 306.
- nodosiata* Hall, Grabau, 306.
- reticularia* Linnaeus 1767, Beecher, 51.
- reticularis* (Linnaeus), Grabau, 306.
- reticularis* (Linnaeus), Kindle, 442.
- reticularis* var. *ellipsoidea* (Nettleroth), Kindle, 442.
- rugosa* Hall, Grabau, 306.
- spinosa* Hall, Kindle, 442.
- Atrypina disparilis* Hall 1852, Beecher, 51.
- Aulopora amplexa* n. sp., Rowley, 658.
- longi* n. sp., Rowley, 658.
- Aviculopecten crausicostata* H. and W., Kindle, 442.
- exactus* Hall, Kindle, 442.
- fusciculatus* Hall, Kindle, 442.
- iowensis* Miller, Weller, 804.
- nebrascensis* n. sp., Beede, 55.

Paleontology—Continued.

Genera and species described—Continued.

Aviculopecten princeps (Conrad) Hall, Kindle, 442.
(Pterinopecten?) terminalis Hall, Kindle, 442.
Aviculopinna knighti n. sp., Beede, 55.
nebrascensis n. sp., Beede, 55.
Axophyllum? alieni n. sp., Rowley, 658.
Balanophyllia desmophyllum Milne-Edwards and Haime, Vaughan, 765.
Barrendella Hall and Clarke, Grabau, 306.
fornicata (Hall), Grabau, 306.
Barriosella subspatulata Meek and Worthen, Kindle, 442.
Basilosurus cetoides (Owen), Lucas, 502.
Bathocypris parilis n. sp., Ulrich, 750.
subaequata n. sp., Ulrich, 750.
Bathygenys n. gen., Douglass, 234a.
Batostoma fertile Ulr., Sardeson, 671.
Batostomella Ulrich, Grabau, 306.
granulifera (Hall), Grabau, 306.
Bellerophon curvilineatus Con., Kindle, 442.
leda Hall, Kindle, 442.
lyra Hall, Kindle, 442.
panneus White, Weller, 804.
patulus Hall, Kindle, 442.
pelope Hall, Kindle, 442.
sp., Kindle, 442.
sp. undet., Weller, 804.
Bicia n. gen., Walcott, 771.
gemma Billings, Walcott, 771.
whiteavesi n. sp., Walcott, 771.
Biflustra torta Gabb and Horn, Ulrich, 751.
Bilobites varicus, Beecher, 51.
Bittium (Elachista) californicum n. sp., Dall and Bartsch, 189.
Bithopphyllum coniferum n. sp., Greene, 319.
greenei n. sp. (Rowley), Greene, 320.
Bolla Jones and Holl, Grabau, 306.
cornucopiae n. sp., Ruedemann, 660.
symmetrica (Hall), Grabau, 306.
Bolporites americanus Billings, Ruedemann, 660.
Bordenia, n. gen., Greene, 320.
zaphrentiformis n. sp., Greene, 320.
Bradaria n. gen., Matthew, 530.
rugulosa n. sp., Matthew, 530.
serutator n. sp., Matthew, 530.
vigilans n. sp., Matthew, 530.
Bronteus Goldfuss, Grabau, 306.
lunatus Billings, Ruedemann, 660.
niagarensis Hall, Grabau, 306.
Brontosaurus, Hatcher, 347.
Brontosaurus, Osborn and Granger, 585.
Bucania Hall, Grabau, 306.
trilobata (Conrad), Grabau, 306.
Bucania devonica Hall and Whitf., Kindle, 442.
Bucanopsis perelegans (W. & W.), Weller, 804.
Buthotrephis divaricata n. sp., White, 809a.
newlini n. sp., White, 809a.
Bythocypris cylindrica Hall sp., Ruedemann, 660.
Bythopora Miller and Dyer, Grabau, 306.
spinulosa (Hall), Grabau, 306.

Paleontology—Continued.

Genera and species described—Continued.

Bythotrephis gracilis Hall, Grabau, 306.
lesquereuxi, Grabau, 306.
Bythinella Moquin-Tandon, Letson, 493.
obtusa (Lea) Binney, Letson, 493.
Cadulus abruptus Meyer and Aldrich, Clark and Martin, 141.
Callianassa Leach, Pilsbry, 613.
mortoni n. sp., Pilsbry, 613.
Callistoma sp., Clark and Martin, 141.
Calloctystes Hall, Grabau, 306.
jewetti Hall, Grabau, 306.
Callonema bellatula Hall, Kindle, 442.
clarki Nettleroth, Kindle, 442.
conus n. sp., Kindle, 442.
imitator (Hall and Whitf.), Kindle, 442.
lilach Hall, Kindle, 442.
Callopore Hall, Grabau, 306.
elegantula Hall, Grabau, 306.
multitubulata Ulr., Sardeson, 671.
Calymene Brongt., Grabau, 306.
blumenbachi niagarensis Hall, Grabau, 306.
platys Green, Kindle, 442.
Calyptraea aperta (Solander), Clark and Martin, 141.
Calyptraphorus jacksoni Clark, Clark and Martin, 141.
trinodiferus Conrad, Clark and Martin, 141.
trinodiferus var. (?), Clark and Martin, 141.
Camarorea bernensis n. sp., Sardeson, 677.
owatonnaensis n. sp., Sardeson, 677.
Camarophorella lenticularis (W. & W.), Weller, 804.
Camarophoria caput-testudinis (White), Weller, 804.
Camarospira eucharis Hall, Kindle, 442.
Camarotecchia Hall and Clarke, Grabau, 306.
acinus Hall 1863, Beecher, 51.
acinus Hall, Grabau, 306.
carolina Hall, Kindle, 442.
congregata (Conrad), Kindle, 442.
heteropsis (Win.), Weller, 804.
indianensis Hall 1863, Beecher, 51.
neglecta Hall 1852, Beecher, 51.
(?) neglecta Hall, Grabau, 306.
nitida n. sp., Kindle, 442.
obtusiplicata Hall, Grabau, 306.
pauciplicata n. sp., Wood, 855.
persinuata (Win.), Weller, 804.
prolifica (?) Hall, Wood, 855.
sappho Hall, Kindle, 442.
tethys (Billings), Kindle, 442.
whitii Hall 1863, Beecher, 51.
Camarosaurus Cope, Riggs, 651.
Campeloma Rafinesque, Letson, 493.
decisa Say, Letson, 493.
Cancellaria graciloides Aldrich var., Clark and Martin, 141.
(Narona) potomacensis n. sp., Clark and Martin, 141.
sp., Clark and Martin, 141.
Capulus cassensis n. sp., Kindle, 442.
paralius (W. & W.), Weller, 804.
vomerium (Win.), Weller, 804.

Paleontology—Continued.

Genera and species described—Continued.

Carcharodon *auriculatus* (Blainville), Case, 251.
Cardiopsis *crassicostata* Hall and Whitfield, Kindle, 442.
Caricella *pyruloides* (?) (Conrad), Clark and Martin, 141.
Carinaropsis *carinata* Hall, Ruedemann, 660.
 —*deleta* n. sp. Sardeson, 677.
 (or *Bellerophon*) *phalera* n. sp., Sardeson, 677.
Carpenteroblastus n. gen., Rowley, 658.
 —*pentagonus* n. sp., Rowley, 658.
Carpolithus *marylandicus* n. sp., Hollick, 387.
 var. *rugosus* n. var., Hollick, 387.
Caryocrinus Say, Grabau, 306.
 —*ornatus* Say, Grabau, 306.
Cavaria *dumosa* n. sp., Ulrich, 751.
Centronella *glaesfagea* (Hall), Kindle, 442.
Ceramopora, Hall, Grabau, 306.
 —*imbricata* Hall, Grabau, 306.
 —*incrustans* Hall, Grabau, 306.
Ceratiocaris McCoy, Grabau, 306.
 —*acuminata* Hall, Grabau, 306.
 (Phasganocaris?) *deweyi* Hall, Grabau, 306.
Ceratocephala *coalescens* n. sp., van Ingen, 763.
 —*goniata* Wärder, van Ingen, 763.
 —*nodulata* n. sp., van Ingen, 763.
Ceratopora *agglomerata* n. sp. (Grabau), Greene, 320.
Ceripora *micropora* Goldfuss, Ulrich, 751.
Chilotrypa Ulrich, Grabau, 306.
 —*ostiolata* (Hall), Grabau, 306.
Chondrodonta n. gen., Stanton, 726.
 —*glabra* n. sp., Stanton, 726.
 —*munsoni* (Hill), Stanton, 726.
Chonetes Fischer de Waldheim, Grabau, 306.
 —*arcuatus* Hall, Kindle, 442.
 —*burlingtonensis* n. sp., Weller, 804.
 —*cornutus* (Hall), Grabau, 306.
 —*gregarius* n. sp., Weller, 804.
 —*lepidus* Hall, Kindle, 442.
 —*manitobensis* Whiteaves, Kindle, 442.
 —*mucronatus* Hall, Kindle, 442.
 —*mucronatus* Hall, Wood, 855.
 —*scitulus* Hall, Wood, 855.
 —*subquadratus* Nettleroth, Kindle, 442.
 —*vicinus* (Castelnau), Kindle, 442.
 —*yandellanus* Hall, Kindle, 442.
Chonopectus *fischeri* (N. & P.), Weller, 804.
Chonophyllum Edwards and Haime, Grabau, 306.
 —*infundibulum* n. sp., Greene, 319.
 —*niagarensis* Hall, Grabau, 306.
 —*typicum* n. sp., Greene, 319.
Chonostrophia *jerinensis* n. sp., Schuchert, 682.
 —*montrealensis* n. sp., Schuchert, 682.
Christiania *trentonensis* n. sp., Ruedemann, 660.
Chrysodomus *engonatus* (Heilprin), Clark and Martin, 141.
Cladopora Hall, Grabau, 306.
 —*multipora* Hall, Grabau, 306.

Paleontology—Continued.

Genera and species described—Continued

Cladopora *seriata* Hall, Grabau, 306.
Claenodon, Matthew, 538.
Clathropora Hall, Grabau, 306.
 —*alicornis* Hall, Grabau, 306.
 —*frondosa* Hall, Grabau, 306.
Clathrospira *subconica* Hall, Ruedemann, 660.
Cleithyris *hirsuta* Hall, Weller, 804.
Climacograptus *scharenbergi*, Ruedemann, 660.
Clinopistha *antiqua* Meek, Kindle, 442.
 —*striata* Nettleroth, Kindle, 442.
 —*subnasuta* Hall and Whitfield, Kindle, 442.
Coleoides *typicus* Walc., Matthew, 529.
Coleolus *tenuicinctum* Hall, Kindle, 442.
Coleophyllum? *greeni* n. sp., Rowley, 658.
Colodon *cingulatus* n. sp., Douglass, 234a.
Colophyllia *gyrosa* (Ellis and Solander), Vaughan, 776.
Conchidium *knighti* (Nettleroth)? Kindle, 442.
Conchopeltis (or *Metoptoma*) *obtusa* n. sp., Sardeson, 677.
Conocardium *cuneus* Hall, Kindle, 442.
 —*ohioense* Meek, Kindle, 442.
 —*puellulum* W. & W., Weller, 804.
Conularia Miller, Grabau, 306.
 —*niagarensis* Hall, Grabau, 306.
 sp., Kindle, 442.
Coralliophaga (*Oryctomyia*) *bryani* Clark, Clark and Martin, 141.
Corbula *aldrichi* Meyer, Clark and Martin, 141.
 —*oniscus* Conrad, Clark and Martin, 141.
 —*subengonata* Dall, Clark and Martin, 141.
Cordaites Unger, Penhallow, 604.
 —*acadianum* Dn., Penhallow, 604.
 —*annulatum* Dn., Penhallow, 604.
 —*brandlingii*, Penhallow, 604.
 —*clarkii* Dn., Penhallow, 604.
 —*halli* Dn., Penhallow, 604.
 —*hamiltonense* n. sp., Penhallow, 604.
 —*illinoiensis* Dn., n. sp., Penhallow, 604.
 —*materiarium* Dn., Penhallow, 604.
 —*matriode* Dn., n. sp., Penhallow, 604.
 —*newberryi* (Dn.) Knowlton, Penhallow, 604.
Ohioense Dn., n. sp., Penhallow, 604.
pennsylvanicum Dn., n. sp., Penhallow, 604.
quangondianum Dn., Penhallow, 604.
recentium Dn., n. sp., Penhallow, 604.
Cornulites Schlotheim, Grabau, 306.
bellistriatus Hall, Grabau, 306.
Cranena *romingeri* Hall, Kindle, 442.
Crania *crenistris* Hall, Kindle, 442.
 —*delicata* n. sp. (Rowley), Greene, 320.
 —*depressa* n. sp. (Rowley), Greene, 320.
 —*granosa* Hall and Clarke, Kindle, 442.
 —*greeni* Miller, Kindle, 442.
 —*halli* n. sp., Sardeson, 677.
 ?*lemoni* n. sp. (Rowley), Greene, 320.
 —*modesta*, W. & St. J. sp. Rowley, Greene, 320.
 —*recta* n. sp., Wood, 855.
 —*robusta* n. sp. (Rowley), Greene, 320.

Paleontology—Continued.

Genera and species described—Continued.

Crania sheldoni White, Kindle, 442.
suliriana Hall 1863, Beecher, 51.
 sp., Kindle, 442.

Craniella hamiltonæ Hall, Kindle, 442.

Cranoceras ? *ellipticum* n. sp. Rowley, Greene, 320.

Crassitellites alæformis (Conrad), Clark and Martin, 141.
alta (Conrad), Clark and Martin, 141.
aquiana (Clark), Clark and Martin, 141.
 sp., Clark and Martin, 141.

Creosaurus Marsh, Williston, 836.

Cribrilia *crassula* n. sp., Ulrich, 751.
modesta n. sp., Ulrich, 751.

Crstellaria *gibba* (d'Orbigny), Bagg, 35.
radiata (Bornemann), Bagg, 35.
rotulata (Lamarck), Bagg, 35.

Cryptonella *lens* Hall, Kindle, 442.

ovalis Miller, Kindle, 442.

Ctenobolbina *ciliata*, Ruedemann, 659.
ciliata var. *cornuta* n. var., Ruedemann, 659.
subrotunda n. sp., Ruedemann, 659..

Ctenodonta cf. *astarræformis* Salter, Ruedemann, 660.

Cucullæa *gigantea* Conrad, Clark and Martin, 141.

Cupressinoxylon *cheyennense* n. sp., Penhallow, 604.
comanchense n. sp., Penhallow, 604.

Cybele sp., Ruedemann, 660.

Cyclonema *cancellata*, Kindle, 442.
crenulata Meek, Kindle, 442.

Cylorrhina *nobilis* Hall, Kindle, 442.

Cylchna *venusta* Clark, Clark and Martin, 141.

Cylindrodon *fontis* n. gen. et sp., Douglass, 234a.

Cyphaspis *hudsonica* n. sp., Ruedemann, 660.
matutina n. sp., Ruedemann, 660.

Cypræa *smithii* Aldrich, Clark and Martin, 141.

Cypricardinia *cataracta* Conrad, Kindle, 442.
? cylindrica H. and W., Kindle, 442.
indenta Conrad, Kindle, 442.

Cypricardites *luculentus* n. sp., Sardeson, 677.
minnesotensis n. sp., Sardeson, 677.
triangularis n. sp., Sardeson, 677.
vicinus n. sp., Sardeson, 677.

Cyrtina Davidson, Grabau, 306.
acutirostris (Shum.)?, Weller, 804.
crassa Hall, Kindle, 442.
hamiltonensis Hall, Kindle, 442.
 var. *recta* Hall, Kindle, 442.
pyramidalis (Hall), Grabau, 306.

Cyrtoceras Goldfuss, Grabau, 306.
expansum n. sp., Kindle, 442.
subcancellatum Hall, Grabau, 306.
 sp., Kindle, 442.

Cyrtolites *bennetti* n. sp., Rowley, 658.

Cyrtospira *attenuata* n. sp., Ruedemann, 660.

Cystelasma *septata* n. sp., Greene, 320.

Cystiphyllum Goldfuss, Grabau, 306.
diversum n. sp., Greene, 319.
expansum n. sp., Greene, 319.

Paleontology—Continued.

Genera and species described—Continued.

Cystiphyllum *hydraulicum* Simpson, Grabau, 306.
louisvillensis n. sp., Greene, 319.
multicrenatum n. sp., Greene, 320.

Cythere *marylandica* n. sp., Ulrich, 750.

Cythereis *bassleri* n. sp., Ulrich, 750.

Cytherella *marlboensis* n. sp., Ulrich, 750.
submarginata n. sp., Ulrich, 750.

Cytheridea *perarecata* n. sp., Ulrich, 750.

Dadoxylon *antiquum* Dn., Penhallow, 604.
edvardianum Dn., Penhallow, 604.
prosseri n. sp., Penhallow, 604.

Dalmanella Hall and Clarke, Grabau, 306.
elegantula Dalman, Grabau, 306.
elegantula Dalman 1827, Beecher, 51.
subæquata var. *parvetus* Conrad, Ruedemann, 660.

Dalmanites Barrande, Grabau, 306.
achates Billings, Ruedemann, 660.
limulurus (Green), Grabau, 306.
(Chasmops), *anchiops* (Green), Kindle, 442.
calypso H. and W., Kindle, 442.

(Cryphæus) *boothi* var. *calliteles* Green (H. and C.), Kindle, 442.
pleione Hall and Clarke, Kindle, 442.

(Hausmannia) *pleuroptyx* Green (Hall?), Kindle, 442.

(Odontocephalus) *ægeria* Hall, Kindle, 442.
selenurus (Hall and Clarke), Kindle, 442.

(Synphoria) *arkansanus* n. sp., Van Ingen, 763.
vigilans Hall, Van Ingen, 763.

Dekayia *cystata* n. sp., Cumings, 180.
magna n. sp., Cumings, 180.

Delthyris *raricosta* Conrad, 442.
sculptilis Hall, Kindle, 442.

Dentalium *grandævum* Win., Weller, 804.
minutistriatum Gabb, Clark and Martin, 141.
mississippiensis Gabb, Clark and Martin, 141.

Dexobia *halli* Win., Weller, 804.
ovata (Hall), Weller, 804.

Diamespora Hall, Grabau, 306.
dichotoma Hall, Grabau, 306.

Diaphorostoma Fischer, Grabau, 306.
niagarensis Hall, Grabau, 306.

Dictyonella Hall, Grabau, 306.
corallifera Hall, Grabau, 306.

Dictyonella *reticulata* Hall 1868, Beecher 51.

Dictyonella Hall, Grabau, 306.
retiforme Hall, Grabau, 306.

Dielasma, Beecher, 51.
? pediculus n. sp., Rowley, 658.
zellei (Win.), Weller, 804.

Diploclema Ulrich, Grabau, 306.
sparsa (Hall), Grabau, 306.

Diplodocus (Marsh), Hatcher, 342.

Diplodocus, Osborn and Granger, 585.

Diplodonta *hopkinsensis* Clark, Clark and Martin, 141.
marlboroensis n. sp., Clark and Martin, 141.

Paleontology—Continued.

Genera and species described—Continued.

Diplophyllum Hall, Grabau, 306.
caespitosum Hall, Grabau, 306.
Diploria labyrinthiformis (Linn.) emend Esper, Vaughan, 766.
Diplopterya limitaris Ulr., Sardeson, 671.
Discina concordensis n. sp., Sardeson, 677.
Discorbina bertheloti (d'Orbigny), Bagg, 35.
turbo (d'Orbigny), Bagg, 35.
Discosparsa varians, n. sp., Ulrich, 751.
Dolichopterus Hall, Grabau, 306.
macrochirus Hall, Grabau, 306.
Dosinopsis lenticularis (Rogers), Clark and Martin, 141.
Dromocyon vorax Marsh, Wortman, 864, 865.
Drymotrypa Ulrich, Grabau, 306.
diffusa (Hall), Grabau, 306.
Eccyliopterus spiralis n. sp., Ruedemann, 660.
Edmondia nuptialis Win., Weller, 804.
strigillata Win., Weller, 804.
Eallophyllum, n. gen., Greene, 320.
grabau n. sp., Greene, 320.
Eocrinurus Emrich, Grabau, 306.
ornatus Hall and Whitfield, Grabau, 306.
punctatus (Brunnich) Wahlenberg van Ingen, 768.
Enterolasma Simpson, Grabau, 306.
caliculus (Hall), Grabau, 306.
Eopolychaetus albanensis n. gen. et sp., Ruedemann, 659.
Epiphragmophora fidelis antecedens Stearns, 727.
Equus barcenaei Cope, Gidley, 292.
complicatus (Leidy), Gidley, 292.
conversidens Owen, Gidley, 292.
crenides Cope, Gidley, 292.
fraternus Leidy, Gidley, 292.
giganteus n. sp., Gidley, 292.
occidentalis Leidy, Gidley, 292.
pacificus Leidy, Gidley, 292.
pectinatus (Cope), Gidley, 292.
scotti Gidley, Gidley, 292.
semiplicatus Cope, Gidley, 292.
tau Owen, Gidley, 292.
Eridotrypa mutabilis Ulr., Sardeson, 671.
vevayensis n. sp., Cumings, 180.
Eschara (?) digitata Morton, Ulrich, 751.
Eucalyptocrinus Goldfuss, Grabau, 306.
decorus (Phillips), Grabau, 306.
Euclastes (?) Clark, Case, 120.
Eucrotaphus helena n. sp., Douglass, 234a.
Eumys minor n. sp., Douglass, 234a.
Eunella harmonia Hall, Kindle, 442.
lineklaeni Hall, Kindle, 442.
sullivanti Hall, Kindle, 442.
Euomphalus planodiscus Hall, Kindle, 442.
sampsoni Nettleroth, Kindle, 442.
(Straparollus) exiguum n. sp., Kindle, 442.
Eupsammia conradi Vaughan, Vaughan, 765.
elaborata (Conrad), Vaughan, 765.
Eurychilina bulbifera n. sp., Ruedemann, 660.
dianthus n. sp., Ruedemann, 660.
obliqua n. sp., Ruedemann, 660.
(?) solida n. sp., Ruedemann, 660.
subradiata var. rensselaerica n. var., Rue-
demann, 660.

Paleontology—Continued.

Genera and species described—Continued.

Eurypterus De Kay, Grabau, 306.
dekeyi Hall, Grabau, 306.
lacustris Harlan, Grabau, 306.
pachycheirus Hall, Grabau, 306.
pustulosus Hall, Grabau, 306.
remipes De Kay, Grabau, 306.
robustus Hall, Grabau, 306.
Eusarcus Grote and Pitt, Grabau, 306.
grandis Grote and Pitt, Grabau, 306.
scorpionis Grote and Pitt, Grabau, 306.
Fascipora subramosa n. sp., Ulrich, 751.
Favia Oken. 1815, Vaughan, 766.
Favosites Lamarck, Grabau, 306.
constrictus (Hall), Grabau, 306.
niagarensis Hall, Grabau, 306.
parasiticus (Hall), Grabau, 306.
pyriformis (Hall), Grabau, 306.
Fenestella Lonsdale, Grabau, 306.
elegans Hall, Grabau, 306.
Fistulipora carbonaris Ulr., Sardeson, 671.
Fissuridea marlboroensis n. sp., Clark and Martin, 141.
Flabellum sp., Vaughan, 765.
Fluminicola columbiana (Hemphill) Pilsbry, Stearns, 727a.
merriami Pilsbry and Beecher, Stearns, 727a.
Fulgurofusus argutus Clark, Clark and Martin, 141.
Fusispira (?) spicula n. sp., Sardeson, 677.
Fusoficula juvenis (Whitfield), Clark and Martin, 141.
Fusus interstitialis Heilprin, Clark and Martin, 141.
(?) subtenuis Heilprin, Clark and Martin, 141.
Galeocerdo latidens Agassiz, Case, 251.
Gastrochæana sp., Clark and Martin, 141.
Gemmaeocrinus carinatus n. sp., Wood, 856.
Gerasaphes ulrichana Clarke, Ruedemann, 660.
Gibbula glandula (Conrad), Clark and Martin, 141.
Globigerina bulloides d'Orbigny, Bagg, 35.
Glossina triangulata Nettleroth, Kindle, 442.
Glycymeris idoneus (Conrad), Clark and Martin, 141.
Glyptias favosa Linnarsson, Walcott, 771.
Glyptocrinus plumosus Hall, Grabau, 306.
Glyptodesma cancelata Nettleroth, Kindle, 442.
erectum Hall, Kindle, 442.
occidentale Hall, Kindle, 442.
Gomphoceras Sowerby, Grabau, 306.
bellatum n. sp. (Rowley), Greene, 320.
facetum n. sp. (Rowley), Greene, 320.
minum Hall, Kindle 442.
oviforme Hall sp. Rowley, Greene, 320.
oviforme Hall, Kindle, 442.
raphanus Hall?, Kindle, 442.
stratum n. sp. (Rowley), Greene, 320.
turbaniforme M. and W., Kindle, 442.
sp., Kindle, 442.

Paleontology—Continued.

Genera and species described—Continued.

Goniatites delphiensis n. sp., Kindle, 442.
discoideus var. ohioensis Hall, Kindle, 442.
wabashensis n. sp., Kindle, 442.

Goniobasis Lea, Letson, 493.
haldemani Tyron, Letson, 493.
levescens (Menke) Tyron, Letson, 493.
var. niagarensis (Lea) Tyron, Letson, 493.

Goniophora hamiltonensis Hall, Kindle, 442.
truncata Hall, Kindle, 442.

Grammysia arcuata Hall, Kindle, 442.
imbricata Rowley, Greene, 320.
secunda var. gibbosa H. and W., Kindle, 442.

subarcuata Hall?, Kindle, 442.

Gryphaea vesicularis Lamarck, Clark and Martin, 141.

Gyridula romingeri var. indianensis nov. var., Kindle, 442.

Gyroceras burlingtonensis Owen, Weller, 804.
indianense n. sp., Kindle, 442.
inelegans Meek?, Kindle, 442.
jason Hall, Kindle, 442.

Halysites Fischer, Grabau, 306.
catenulatus (Linn.), Grabau, 306.

Harpagolestes macrocephalus n. gen. et sp., Wortman, 864.

Harpalodon sylvestris Marsh, Wortman, 863.

Helenia granulata n. sp., Matthew, 529.

Helicoceras stevensonii, Whitfield, 823.

Heliolites Guettard, Grabau, 306.
elegans Hall, Grabau, 306.
pyriformis Guettard, Grabau, 306.
spiniporus Hall, Grabau, 306.

Heliophyllum ampliatum n. sp., Greene, 321.
collatum n. sp., Greene, 320.
conigerum n. sp., Greene, 320.
hammelli n. sp., Greene, 320.
rowleyi n. sp., Greene, 319.
spiculatum n. sp., Greene, 320.

Helopora Hall, Grabau, 306.
fragilis Hall, Grabau, 306.

Hercoglossa tuomeyi n. sp., Clark and Martin, 141.

Hetepora (?) tecta n. sp., Ulrich, 751.

Hippurion erythrus (Cope), Gidley, 292.

Holopea conica Win., Weller, 804.
(?) perundosa n. sp., Sardeson, 677.

Homalonotus Koenig, Grabau, 306.
delphinocephalus (Green), Grabau, 306.

Homeospira Hall and Clarke, Grabau, 306.
apriniformis Hall, Grabau, 306.
evax Hall 1863, Beecher, 51.
sobrina n. sp., Beecher, 51.

Homotrypa minnesotensis Ulr., Sardeson, 671.

Hoploparia McCoy, Pilsbry, 613.
gabbi n. sp., Pilsbry, 613.

Hyænodon minutus n. sp., Douglass, 234a.
montanus n. sp., Douglass, 234a.

Hyatella Hall and Clarke, Grabau, 306.
congesta (Conrad), Grabau, 306.

Hyolithellus (?) flexuosus n. sp., Matthew, 529.

micans Billings, Matthew, 529.
micans Billings, Ruedemann, 660.

Paleontology—Continued.

Genera and species described—Continued.

Hyolithes excellens Bill., Matthew, 529.
rugosus n. sp., Matthew, 529.

Hyolithus rhine n. sp., Ruedemann, 660.

Ichthyocrinus Conrad, Grabau, 306.
lævis Conrad, Grabau, 306.

Ictops acutidens n. sp., Douglass, 234a.

Igoceras undata (Win.), Weller, 804.

Illænus Dalman, Grabau, 306.
americanus Billings, Ruedemann, 660.
ioxus Hall, Grabau, 306.

Isochilina Jones, Grabau, 306.
armata var. pygmæa n. var., Ruedemann, 660.
cylindrica (Hall), Grabau, 306.

Isomene humilis Meek?, Kindle, 442.

Isopora Studer. 1878, Vaughan, 766.
muricata (Linnæus) forma muricata s.s.
(=cervicornis Lamarck), Vaughan, 766.

Isotelus maximus Locke, Ruedemann, 660.

Kutorgina granulata n. sp., Matthew, 529.

Lampadis Rafin'sque, Letson, 493.
ellipsiformis (Conr.) Simpson, Letson, 493.
rectus (Lam.) Smith, Letson, 493.

Latirus marylandicus n. sp., Clark and Martin, 141.

Lecanocrinus Hall, Grabau, 306.
macropetalus Hall, Grabau, 306.

Leda cliftonensis n. sp., Clark and Martin, 141.
cultelliformis (Rogers), Clark and Martin, 141.
improcera (Conrad), Clark and Martin, 141.

parilis (Conrad), Clark and Martin, 141.
var., Clark and Martin, 141.

parva (Rogers), Clark and Martin, 141.
potomacensis n. sp., Clark and Martin, 141.
saccata (Win.), Weller, 804.
tysoni n. sp., Clark and Martin, 141.

Leiorhynchus limitare (Vanuxem), Kindle, 442.

quadricostatum (Vanuxem), Kindle, 442.

Leperditia Rouault, Grabau, 306.
fabulites Conrad sp., Ruedemann, 660.
resplendens n. sp., Ruedemann, 660.
scalaris Jones, Grabau, 306.

Lepidocoleus jamesi Hall and Whitfield sp., Ruedemann, 660.

Lepidodiscus alleganius n. sp., Clarke, 146.

Lepralia labiosa n. sp., Ulrich, 751.
subplana n. sp., Ulrich, 751.

Leptena Dalman, Grabau, 306.
minnesotensis n. sp., Sardeson, 677.
præcosus n. sp., Sardeson, 677.
recedens n. sp., Sardeson, 677.
rhomboidalis (Wahlenberg), Grabau, 306.
saxea n. sp., Sardeson, 677.
rhomboidalis Wilckens, 1769, Beecher, 51.
rhomboidalis (Wilckens), Kindle, 442.
rhomboidalis Wilckens, Ruedemann, 660.
rhomboidalis (Wilck.), Weller, 804.

Leptobolus atavus n. sp., Matthew, 530.
(?) collicia n. sp., Matthew, 530.
walcotti n. sp., Ruedemann, 659

Paleontology—Continued.

Genera and species described—Continued.

- Leptodesma marcellense Hall, Wood, 855.
rogersi Hall, Kindle, 442.
- Leptopora ramosa n. sp., Rowley, 658.
procerata n. sp., Rowley, 658.
typa Win., Weller, 804.
- Leptopsis levettei, White, Rowley, Greene, 320.
- Leuciscus turneri n. sp., Lucas, 504.
- Levifusus trabeatus (?) Conrad, Clark and Martin, 141.
trabeatus (?) var., Clark and Martin, 141.
- Lichesia Dalman, Grabau, 306.
boltoni (Bigsby), Grabau, 306.
nereus Hall, Van Ingen, 763.
sp., Kindle, 442.
- Lichenalia Hall, Grabau, 306.
concentrica Hall, Grabau, 306.
- Limnea Lamarck, Letson, 493.
catascopium Say, Letson, 493.
columella Say, Letson, 493.
desidiosa Say, Letson, 493.
- Limnenetes n. gen., Douglass, 234a.
(?) anceps n. sp., Douglass, 234a.
platyceps n. sp., Douglass, 234a.
- Limoptera cancellata Hall, Kindle, 442.
- Lingula Bruguiere, Grabau, 306.
cuneata Conrad, Grabau, 306.
spatulata Vanuxem, Kindle, 442.
- Lingulella gregaria n. sp., Matthew, 530.
tumida n. sp., Matthew, 530.
- Lioclema Ulrich, Grabau, 306.
aspera (Hall), Grabau, 306.
florida (Hall), Grabau, 306.
- Liopteria Hall, Grabau, 306.
(?) subplanata (Hall), Grabau, 306.
- Liospira americana Billings sp., Ruedemann, 660.
subtilistriata Hall sp., Ruedemann, 660.
- Lithophaga marylandica n. sp., Clark and Martin, 141.
minuta n. sp., Weller, 804.
- Litiopa marylandica n. sp., Clark and Martin, 141.
- Loirhynchus limitare (Vanuxem), Wood, 855.
- Lophoblastus n. gen., Rowley, 658.
conoideus n. sp., Rowley, 658.
marginulus n. sp., Rowley, 658.
- Loxonema hamiltoniae Hall, Kindle, 442.
hydraulica Hall, Kindle, 442.
laeviculum Hall, Kindle, 442.
rectistriatum Hall, Kindle, 442.
(?) teres Hall, Kindle, 442.
sp., Kindle, 442.
sp. undet., Weller, 804.
- Lucina aquiana Clark, Clark and Martin, 141.
astartiformis Aldrich, Clark and Martin, 141.
dartoni Clark and Martin, 141.
megameris, Dall, 188.
uhleri Clark, Clark and Martin, 141.
whitei Clark, Clark and Martin, 141.
sp., Clark and Martin, 141.
- Lunatia marylandica Conrad, Clark and Martin, 141.
- Lunulicardium fragile Hall, Wood, 855

Paleontology—Continued.

Genera and species described—Continued.

- Lunulites reversa n. sp., Ulrich, 751.
- Lyriocrinus dactylus Hall, Grabau, 306.
- Lyripecten Hall, Grabau, 306.
orbiculoides (nom.) (nov.), Grabau, 306.
- Lytoceras (Gaudryceras) denmanense, Whiteaves, 820.
- Macrocheilina carinatus Nettleroth, Kindle, 442.
hebe Hall, Kindle, 442.
onondagensis n. sp., Clarke, 145.
sp., Kindle, 442.
- Mancala californiensis n. sp., Lucas, 504a.
- Macrodon parvus W. & W., Weller, 804.
- Macronotella fragaria n. sp., Ruedemann, 660.
ulrichi n. sp., Ruedemann, 660.
- Mangilia (Pleurotomella) bellistriata, Clark and Martin, 141.
- Marginulina costata (Batsch.), Bagg, 35.
- Martinia subumbona (Hall), Kindle, 442.
williamsi n. sp., Kindle, 442.
- Meandrina Lamarck, Vaughan, 766.
meandrites (Linnæus), Vaughan, 766.
- Megistocrinus circulus n. sp. (Rowley), Greene, 320.
corniger n. sp. (Rowley), Greene, 320.
expansus, Miller & Gurley, Rowley, Greene, 320.
expansus var. inflatus, n. var. (Rowley), Greene, 320.
unicornis n. sp. (Rowley), Greene, 320.
- Melania exigua Conrad, Stearns, 727a.
- Melongena (?) potomacensis n. sp., Clark and Martin, 141.
- Membranipora angusta n. sp., Ulrich, 751.
rimulata n. sp., Ulrich, 751.
spiculosa n. sp., Ulrich, 751.
- Meretrix lens (Conrad), Clark and Martin, 141.
ovata var. ovata (Rogers), Clark and Martin, 141.
ovata var. pyga Conrad, Clark and Martin, 141.
subimpressa Conrad, Clark and Martin, 141.
- Meristella barrisi Hall, Kindle, 442.
nasuta (Conrad), Kindle, 442.
- Meristina maria Hall 1863, Beecher, 51.
rectirostris Hall 1882, Beecher, 51.
- Merycochœrus altiramus n. sp., Douglas, 234.
compressidens n. sp., Douglas, 234.
elrodi n. sp., Douglas, 234.
madisonius n. sp., Douglas, 234.
? obliquidens?, Douglas, 234.
- Mesalia obruta (Conrad), Clark and Martin, 141.
- Metopoma explanata n. sp., Sardeson, 677.
- Metula marylandica n. sp., Clark and Martin, 141.
- Michelinia convexa D'Orbigny, Beecher, 51.
- Microdon leptogaster (Win.), Weller, 804.
- Mimulus waldronensis Miller and Dyer 1878, Beecher, 51.
- Mitra marylandica Clark, Clark and Martin, 141.
pomonkensis n. sp., Clark and Martin, 141.

Paleontology—Continued.*Genera and species described—Continued.*

Mitra potomacensis n. sp., Clark and Martin, 141.
 Modiolopsis Hall, Grabau, 306.
 aviculoides Hall, Ruedemann, 660.
 orthonata (Conrad), Grabau, 306.
 primigenia (Conrad), Grabau, 306.
 cf. subalatus, Grabau, 306.
 thecoides n. sp., Matthew, 529.
 Modiolus alabamensis Aldrich, Clark and Martin, 141.
 marylandicus n. sp., Clark and Martin, 141.
 Modiomorpha affinis Hall, Kindle, 442.
 alta Hall, Kindle, 442.
 charlestowensis Nettleroth, Kindle, 442.
 concentrica Hall, Kindle, 442.
 myteloides Con., Kindle, 442.
 recta Hall, Kindle, 442.
 Monilopora beecheri Grabau, Greene, 320.
 Monotrypa magna Ulr., Sardeson, 671.
 Morio brevedentata (Aldrich), Clark and Martin, 141.
 Morosaurus, Osborn and Granger, 585.
 grandis, Riggs, 651.
 Mucronella aspera n. sp., Ulrich, 751.
 Murchisonia desiderata Hall, Kindle, 442.
 Myliobatis Cuvier, Case, 251.
 copeanus Clark, Case, 251.
 magister Leidy, Case, 251.
 Mylostoma Newberry, Dean, 228.
 Nassa beaumontensis Aldr., Alderson, 10.
 Natica cliftonensis Clark, Clark and Martin, 141.
 Naticopsis dubia n. sp. (Rowley), Greene, 320.
 levis Meek, Kindle, 442.
 sp., Kindle, 442.
 Nautilus maximus (Conrad), Kindle, 442.
 Nematophycus Caruthers, Grabau, 306.
 crassus (Penhallow), Grabau, 306.
 Neovulpavus washakius n. gen. et sp., Wortman, 861.
 Niso umbilicata (Lea), Clark and Martin, 141.
 Nodosaria affinis (d'Orbigny), Bagg, 35.
 bacillum Defrance, Bagg, 35.
 communis (d'Orbigny), Bagg, 35.
 consobrina var. emaciata (Reuss), Bagg, 35.
 obliqua (Linné), Bagg, 35.
 sandbergeri (Reuss), Bagg, 35.
 Nonionima affinis Reuss, Bagg, 35.
 Nucleospira barrisi (White), Rowley, 568.
 barris White, Weller, 804.
 concinna H. l., Kindle, 442.
 Nucula corbuliformis Hall?, Kindle, 442.
 hanoverensis n. sp., Kindle, 442.
 herzeri Nettleroth, Kindle, 442.
 iowensis W. and W., Weller, 804.
 lamellata Hall, Kindle, 442.
 lirata Conrad, Kindle, 442.
 neda Hall, Kindle, 442.
 niotica Hall, Kindle, 442.
 ovula Lea, Clark and Martin, 141.
 potomacensis n. sp., Clark and Martin, 141.
 Obolella Billings 1861, Walcott, 771.

Paleontology—Continued.*Genera and species described—Continued.*

Obolella c. f. chromatica Billings, Matthew, 529.
 lindstroemi n. sp., Walcott, 771.
 mobergi n. sp., Walcott, 771.
 (Glyptias) favosa Linnarsson, Walcott, 771.
 Obolus, Walcott, 771.
 (?) meneghini n. sp., Walcott, 771.
 tetensis n. sp., Walcott, 771.
 zoppi n. sp., Walcott, 771.
 (Acritis?) rugatus n. sp., Walcott, 771.
 (Lingulella) bellus Walcott, Walcott, 771.
 bicensis n. sp., Walcott, 771.
 bornemanni n. sp., Walcott, 771.
 linnarsoni n. sp., Walcott, 771.
 randomensis n. sp., Walcott, 771.
 schucherti n. sp., Walcott, 771.
 siemiradzkii n. sp., Walcott, 771.
 winona var. convexus, Walcott, 771.
 (Lingulepis) gregwa Matthew, Walcott, 771.
 Odontaspis elegans (Agassiz), Case, 251.
 cuspidata (Agassiz), Case, 251.
 macrota (Agassiz), Case, 251.
 Odontopleura arkansana n. sp., Van Ingen, 763.
 Odontostoma trapaquara (Harris), Clark and Martin, 141.
 Olenellus (Holmia) walcottanus n. sp., Waner, 776.
 Onychochilus (?) nitidulus? Clarke, Wood, 856.
 Oodectes pestooides n. gen. et sp., Wortman, 862, 863.
 Orbicella Dana 1846, Vaughan, 766.
 acropora (Linnaeus), Vaughan, 766.
 cavernosa (Linnaeus), Vaughan, 766.
 tenuis Duncan, Vaughan, 766.
 Orbiculoidea doria Hall, Kindle, 442.
 lodiensis (Vanuxem) ?, Kindle, 442.
 parva n. sp. (Rowley), Greene, 320.
 Oreodon robustum n. sp., Douglass, 234a.
 Orthis Dalman, Grabau, 306.
 corpulenta n. sp., Sardeson, 677.
 flabillites Foerste, Grabau, 306.
 macrior n. sp., Sardeson, 677.
 minnesotensis n. sp., Sardeson, 677.
 petrae n. sp., Sardeson, 677.
 (?) punctostriata Hall, Grabau, 306.
 rogata n. sp. or var., Sardeson, 677.
 tersus n. sp., Sardeson, 677.
 tricenaria Conrad, Ruedemann, 660.
 Orthoceras Breyn, Grabau, 306.
 annulatum Sowerby, Grabau, 306.
 caldwellensis Miller and Gurley, Kindle, 442.
 indianense Hall, Weller, 804.
 marcellense Vanuxem, Wood, 855.
 medullare Hall, Grabau, 306.
 multiseptum Hall, Grabau, 306.
 thoas Hall, Kindle, 442.
 sp., Kindle, 442.
 Orthostrophia Hall, Grabau, 306.
 (?) fasciata Hall, Grabau, 306.
 Orthotheca bayonet n. sp., Matthew, 529.
 pugio n. sp., Matthew, 529.
 sica n. sp., Matthew, 529.

Paleontology—Continued.

Genera and species described—Continued.

- Orthotheca stilletto, Matthew, 529.
- Orthothetes Fischer de Waldheim, Grabau, 306.
- chemungensis arctistriatus Hall, Kindle, 442.
- hydraulicus (Whitfield), Grabau, 306.
- inæqualis (Hall), Weller, 804.
- inflatus? (W. and W.), Weller, 804.
- minutus n. sp., Cumings, 179.
- subplanus Conrad 1842, Beecher, 51.
- subplanus (Conrad), Grabau, 306.
- sp. undet., Weller, 804.
- Ostrea compressirostra, Say, Clark and Martin, 141.
- var. alepidota Dall, Clark, and Martin, 141.
- selliformis Conrad, Clark and Martin, (Gryphæostrea) vomer (Morton), Clark and Martin, 141.
- Otodus obliquus Agassiz, Case, 251.
- Pachyæna gigantea O. and W., Matthew, 538.
- Pachydistya foliata Ulr., Sardeson, 672.
- Palæobolus n. subgen., Matthew, 530.
- bretonensis, Matthew, 530.
- Palæolagus temnodon n. sp., Douglass, 234a.
- Palæoneillo barrisi (W. and W.), Weller, 804.
- microdonta (Win.), Weller, 804.
- sp., Kindle, 442.
- Palæosinopa veterima n. gen. et sp., Matthew, 538.
- Paludestrina longinqua Gould (Pilsbry), Stearns, 727a.
- protea Gould (Pilsbry), Stearns, 727a.
- Panenka radians (Hall), Kindle, 442.
- Panepa elongata Conrad, Clark and Martin, 141.
- Paracyathus marylandicus n. sp., Vaughan, 765.
- Paracyclas elliptica Hall, Kindle, 442.
- elongata Nettleroth, Kindle, 442.
- lirata (Conrad), Kindle, 442.
- octorlonii Nettleroth, Kindle, 442.
- ohioensis (Meek), Kindle, 442.
- Parazyga hirsuta Hall, Kindle, 442.
- Parmophorella (?) paupera Bill., Matthew, 529.
- Paterula amii Schuchert, Ruedemann, 659.
- Pecten choctawensis Aldrich, Clark and Martin, 141.
- dalli Clark, Clark and Martin, 141.
- johnsoni Clark, Clark and Martin, 141.
- sp., Clark and Martin, 141.
- Pentagonia unisulcata (Conrad), Kindle, 442.
- Pentamerella arata (Conrad), Kindle, 442.
- pavilonensis Hall, Kindle, 442.
- thusnelda Nettleroth, Kindle, 442.
- Pentamerus Sowerby, Grabau, 306.
- oblongus Sowerby, Grabau, 306.
- Pentremites altus n. sp. (Rowley), Greene, 320.
- Pernopecten cooperensis (Shumard), Weller, 804
- Phacops cristata Hall, Kindle, 442.
- cristata var. pipa H. and C., Kindle, 442.
- rana (Green), Kindle, 442.
- Phanerotinus paradoxus Win., Weller, 804.

Paleontology—Continued.

Genera and species described—Continued.

- Phenacomya petrosa (Conrad), Clark and Martin, 141.
- Pholadomya marylandica Conrad, Clark and Martin, 141.
- Pholidops Hall, Grabau, 306.
- squamiformis Hall, Grabau, 306.
- sp., Kindle, 442.
- Pholidostrophia iowensis (Owen), Kindle, 442.
- Phylloidus Agassiz, Case, 251.
- hipparionyx n. sp., Case, 251.
- Phylloporina Ulrich, Grabau, 306.
- asperato-striata (Hall), Grabau, 306.
- corticosa Ulr., Sardeson, 672.
- heterostropha Say, Letson, 493.
- Pinnas (?) coprolitiformis n. sp., Beede, 55.
- Pisidium Pfeiffer, Letson, 493.
- abditum Hald., Letson, 493.
- compressum Prime, Letson, 493.
- scutellatum Sterki, Letson, 493.
- ultramontanum Prime, Letson, 493.
- virginicum (Gmelin) Bourg., Letson, 493.
- Pityoxylon chasense n. sp., Penhallow, 604.
- Planorbis Guettard, Letson, 493.
- bicarinatus Say, Letson, 493.
- parvus Say, Letson, 493.
- Platidia marylandica n. sp., Clark and Martin, 142.
- Platyceras Conrad, Grabau, 306.
- angulatum (Hall), Grabau, 306.
- ammon Hall, Kindle, 442.
- (?) arctostoma Ulrich, Kindle, 442.
- blatchleyi n. sp., Kindle, 442.
- bucculentum Hall, Kindle, 442.
- carinatum Hall, Kindle, 442.
- circularis n. sp. (Rowley), Greene, 320.
- compressum Nettleroth, Kindle, 442.
- compressum var., Kindle, 442.
- conicum Hall, Kindle, 442.
- crassum Hall?, Kindle, 442.
- cymbula n. sp., Matthew, 529.
- dumosum Conrad, Kindle, 442.
- dumosum var. pileum n. var., Kindle, 442.
- dumosum var. r. rispinum Hall, Kindle, 442.
- echinatum Hall, Kindle, 442.
- fornicatum, Kindle, 442.
- linerare n. sp., Kindle, 442.
- milleri Nettleroth, Kindle, 442.
- multispinosum Meek, Kindle, 442.
- niagarense (Hall), Grabau, 306.
- radiatum n. sp., Matthew, 529.
- rietum Hall, Kindle, 442.
- rietum var. spinosa n. var., Kindle, 442.
- subcirculare n. sp., Kindle, 442.
- symmetricum Hall, Kindle, 442.
- thetis Hall, Kindle, 442.
- transversum n. sp., Matthew, 529.
- ventricosum Conrad, Kindle, 442.
- sp., Kindle, 442.
- (Orthonychia) fluctuosum Ulrich, Kindle, 442.
- Platygyra Ehrenberg 1834, Vaughan, 766.
- clivosa (Ellis and Solander), Vaughan, 766.

Paleontology—Continued.

Genera and species described—Continued.

Platygyra *viridis* (Le Seur), Vaughan, 766.
Platystomia *pleurotomata* Hall, Kindle, 442.
 lineata Conrad, Kindle, 442.
 lineatum var. *callosum* Hall, Kindle, 442.
niagarensis Hall, Rowley, Greene, 320.
turbinata Hall, Kindle, 442.
turbinata var. *cochleata*, Kindle, 442.
 sp., Kindle, 442.
Platystrophia *biforata* Schlotheim sp., Ruedemann, 660.
Plectambonites Pander, Grabau, 306.
 pisum n. sp., Ruedemann, 660.
sericea (Sowerby), Grabau, 306.
sericeus Sowerby var. *asper* James, Ruedemann, 660.
transversalis (Wahlenberg), Grabau, 306.
Plethospira *socialis* Girty ?, Kindle, 442.
Pleuroceras Rafinesque, Letson, 493.
 subulare Lea, Letson, 493.
Pleurodictyum lenticulare, Beecher, 51.
Pleuronotus *decewi* (Billings), Kindle, 442.
Pleurotoma *ducatellii* n. sp., Clark and Martin, 141.
 harrisi Clark, Clark and Martin, 141.
piscatavensis n. sp., Clark and Martin, 141.
potomacensis n. sp., Clark and Martin, 141.
tysoni n. sp., Clark and Martin, 141.
 (Hemipleurotoma) *childreni* Lea, Clark and Martin, 141.
Pleurotomaria De France, Grabau, 306.
 clivosa n. sp., Sardeson, 677.
littorea Hall, Grabau, 306.
lucina Hall, Kindle, 442.
lucina var. *perfasciata* Hall, Kindle, 442.
pervetusta (Conrad), Grabau, 306.
procteri Nettleroth, Kindle, 442.
?quinquesulcata Win., Weller, 804.
sulcograminata Conrad, Kindle, 442.
 sp., Kindle, 442.
?sp. undet., Weller, 804.

Pliohippus *simplicidens* Cope, Gidley, 292.
Policipes *siluricus* n. sp., Ruedemann, 659.
Polygyra *dalli* Stearns, 727.
Polymorphina *austriaca* (d'Orbigny), Bagg, 35.
 communis (d'Orbigny), Bagg, 35.
 compressa d'Orbigny, Bagg, 35.
 elegans Parker and Jones, Bagg, 35.
gibba (d'Orbigny), Bagg, 35.
lactea (Walker and Jacob), Bagg, 35.
praelonga Terquem, Bagg, 35.
Polyphemopsis *louisvillae* Hall and Whitfield, Kindle, 442.
Polypora McCoy, Grabau, 306.
incepta Hall, Grabau, 306.
Pomatopopsis Tryon, Letson, 493.
 lapidaria (Say) Tryon, Letson, 493.
Pontobdellopsis *cometa* n. gen. et sp., Ruedemann, 659.
Porites *astreoides* Lamarck, Vaughan, 766.
 porites (Pallas), Vaughan, 766.
Portochelys *laticeps* n. gen. et sp., Williston, 837.
Prasopora *simulatrix* Ulrich, Sardeson, 671.
 simulatrix var. *orientalis* Ulrich, Ruedemann, 660.

Paleontology—Continued.

Genera and species described—Continued.

Primitia *mundula* var. *jonesi* n. var., Ruedemann, 660.
Prodophoenus Wortman and Matthew, Wortman, 861.
Prodromites n. gen., Smith and Weller, 711.
 gorbyi Miller, Smith and Weller, 711.
praematurus n. sp., Smith and Weller, 711.
Productella *concentrica* (Hall), Weller, 804.
 minneapolis n. sp., Sardeson, 677.
semiglobosa Nettleroth, Kindle, 442.
spinulicosta Hall, Kindle, 442.
Productus *arcuatus* Hall, Weller, 804.
 morrilliensis Win., Weller, 804.
parvicostatus n. sp. (Rowley), Greene, 320.
parvulus Win., Weller, 804.
punctatus Martin, Weller, 804.
Proetus *canaliculatus* Hall, Kindle, 442.
 clarus Hall, Kindle, 442.
corrugatus n. sp., van Ingen, 763.
crassimarginatus Hall, Kindle, 442.
curvimarginatus Hall and Clarke, Kindle, 442.
folliceps Hall and Clarke, Kindle, 442.
latimarginatus Hall and Clarke, Kindle, 442.
macrocephalus Hall, Kindle, 442.
microgemma Hall and Clarke, Kindle, 442.
subannulatus n. sp., Van Ingen, 763.
Promacrus *cuneatus* Hall, Weller, 804.
Protapirus *robustus* n. sp., Sinclair, 703.
Protocardia *lenis* Conrad, Clark and Martin, 141.
Prototippus *cumminsii* (Cope), Gidley, 292.
 phlegon (Hay), Gidley, 292.
Protowarthia *cancellata* Hall sp., Ruedemann, 660.
Protozyga *exigua* Hall, Ruedemann, 660.
Pteria *limula* (Conrad), Clark and Martin, 141.
Pterinea Goldfuss, Grabau, 306.
 emacerata (Conrad), Grabau, 306.
flabella (Con.) Hall, Kindle, 442.
grandis Hall, Kindle, 442.
Pterinopecten *nodocostatus* (W. and W.), Weller, 804.
 nodosus Hall, Kindle, 442.
reflexus Hall, Kindle, 442.
undosus Hall, Kindle, 442.
Pterygometopus *eboraceus* Schmidt, Ruedemann, 660.
Pterygotus Agassiz, Grabau, 306.
 cobbi Hall, Grabau, 306.
globicaudatus Pohlman, Grabau, 306.
macrothalamus Hall, Grabau, 306.
Ptilodictya (Escharopora) *subrecta* Ulrich, Sardeson, 672.
Ptychodesma *knappianum* H. and W., Kindle, 442.
Pseudoliva sp., Clark and Martin, 141.
Pugnax *striatocostata* (M. and W.), Weller 804.
Pulvinulina *exigua* var. *obtusa* Burrows, Bagg, 85.
schreibersii (d'Orbigny), Bagg, 35.

Paleontology—Continued.

Genera and species described—Continued.

Pyramidula perspectiva *simillima*, Stanton, 727.
Pyrula penita var. *Conrad*, Clark and Martin, 141.
 (?) sp., Clark and Martin, 141.
Quadrula *Rafinesque*, Letson, 493.
coccinea (*Conrad*) *Simpson*, Letson, 493.
solida (*Lea*) *Simpson*, Letson, 493.
Rafniscina alternata (*Emmons*) *Hall* and *Clarke*, *Ruedemann*, 660.
deltoidea *Conrad* var., *Ruedemann*, 660.
Randomia n. gen., *Matthew*, 529.
aurorae n. sp., *Matthew*, 529.
Remopleurides tumidus n. sp., *Ruedemann*, 660.
 (*Caphyra*) *linguatus* n. sp., *Ruedemann*, 660.
Reptofustrella heteropora *Gabb* and *Horn*, *Ulrich*, 751.
Reticularia bicostata *Vanuxem* 1842, var. *pettila* *Hall*, 1879, *Beecher*, 51.
cooperensis (*Swallow*), *Weller*, 804.
fimbriata (*Conrad*), *Kindle*, 442.
Knappianum *Nettleroth*, *Kindle*, 442.
wabashensis n. sp., *Kindle*, 442.
Reticulipora dichotoma *Gabb* and *Horn*, *Ulrich*, 751.
Rhinidietya mutabilis *Ulrich*, *Sardeson*, 672.
Rhinopora *Hall*, *Grabau*, 306.
tuberculosa *Hall*, *Grabau*, 306.
Rhipidomella *Oehlert*, *Grabau*, 306.
burlingtonensis (*Hall*), *Weller*, 804.
circulus *Hall*, *Grabau*, 306.
goodwini *Nettleroth*, *Kindle*, 442.
hybrida *Sowerby*, 1839, *Beecher*, 51.
hybrida (*Sowerby*), *Grabau*, 306.
leucosia *Hall*, *Kindle*, 442.
livia (*Billings*?), *Kindle*, 442.
vanuxemi *Hall*, *Kindle*, 442.
Rhombopora lepidendroides *Meek*, *Sardeson*, 672.
Rhynchonella *Fischer de Waldeheim*, *Grabau*, 306.
 (?) *bidens* *Hall*, *Grabau*, 306.
 (?) *bidentata* (*Hisinger*), *Grabau*, 306.
robusta *Hall*, *Grabau*, 306.
Rhynchonella minnesotensis n. sp., *Sardeson*, 677.
sancta n. sp., *Sardeson*, 677.
depressa n. sp., *Kindle*, 442.
gainesi *Nettleroth*, *Kindle*, 442.
 var. *cassensis* n. var., *Kindle*, 442.
louisvillensis *Nettleroth*, *Kindle*, 442.
tenuistriata *Nettleroth*, *Kindle*, 442.
Rynchopora postulosa (*White*), *Weller*, 804.
Rhynchotreta *Hall*, *Grabau*, 306.
cuneata *Dalman* 1827, var. *americana* *Hall* 1879, *Beecher*, 51.
 var. *americana* *Hall*, *Grabau*, 306.
Ringicula dalli *Clark*, *Clark* and *Martin*, 141.
Roemerella grandis (*Vanuxem*), *Kindle*, 442.
Romingeria cystoides n. sp. (*Grabau*), *Greene*, 320.
Sabal rigada, *Hatcher*, 344

Paleontology—Continued.

Genera and species described—Continued.

Sanguinolites? *sanduskyensis* *Meek*, *Kindle*, 442.
Scala carinata *Lea*, *Clark* and *Martin*, 141.
potomacensis n. sp., *Clark* and *Martin*, 141.
 sessilis *Conrad*, *Clark* and *Martin*, 141.
virginiana *Clark*, *Clark* and *Martin*, 141.
Scaphiocrinus? *longitentaculatus* n. sp. (*Rowley*), *Greene*, 320.
Scenidea c. f. *reticulata* *Billings*, *Matthew*, 529.
 c. f. *retusa* *Ford*, *Matthew*, 529.
Scenidium *Hall*, *Grabau*, 306.
 pyramidale *Hall*, *Grabau*, 306.
Schizobolus concentricus (*Vanuxem*), *Kindle*, 442.
Schizodus contractus *Hall*, *Kindle*, 442.
trigonalis (*Win.*), *Weller*, 804.
Schizophoria striatula (*Schlotheim*), *Kindle*, 442.
 subelliptica (*W.* and *W.*), *Weller*, 804.
Schizotreta papilliformis n. sp., *Ruedemann*, 659.
Schmidtella (?) *acuta* n. sp., *Matthew*, 530.
perverta n. sp., *Matthew*, 530.
crassimarginata var. *ventrilabiata* n. var., *Ruedemann*, 660.
Sciurus jeffersoni n. sp., *Douglass*, 234a.
Selenosteus kepleri n. gen. et sp., *Dean*, 227.
Semicoscinium *Prout*, *Grabau*, 306.
tenuiceps (*Hall*), *Grabau*, 306.
Sepnopora biserialis (*Swal.*), *Sardeson*, 672.
Siderastrea radians (*Pallas*), *Vaughan*, 766.
siderea (*Ellis* and *Solander*), *Vaughan*, 766.
Sinopa Leidy, *Matthew*, 538.
agilis (*Marsh*), *Matthew*, 538.
hians (*Cope*), *Matthew*, 538.
opisthotoma n. sp., *Matthew*, 538.
rapax *Leidy*, *Matthew*, 538.
strenua (*Cope*), *Matthew*, 538.
vera (*Marsh*), *Matthew*, 538.
viverrina (*Cope*), *Matthew*, 538.
whitiae (*Cope*), *Matthew*, 538.
Siphonetreta minnesotensis *Hall* and *Clarke*, *Ruedemann*, 660.
Skenidium anthonensis n. sp., *Sardeson*, 677.
Solarium sp., *Clark* and *Martin*, 141.
Solemya (*Janeia*) *vetusta* *Meek*, *Kindle*, 442.
Solen lisbonensis (?) *Aldrich*, *Clark* and *Martin*, 141.
Spathella phaselia (*Win.*), *Weller*, 804.
Spathocharis emersoni *Clark*, *Kindle*, 442.
Sphaerium *Scopoli*, *Letson*, 493.
 stamineum (*Conr.*) *Prime*, *Letson*, 493.
striatinum (*Lam.*) *Prime*, *Letson*, 493.
Sphaerocoryphe major n. sp., *Ruedemann*, 660.
Sphenotus cylindricus (*Win.*), *Weller*, 804.
Sphyraena præsa *Agassiz*, *Case*, 251.
Spirifer *Sowerby*, *Grabau*, 306.
 acuminatus (*Conrad*), *Kindle*, 442.
 audaculus (*Conrad*), *Kindle*, 442.
arctisegmentum *Hall*, *Kindle*, 442.
byrnesi *Nettleroth*, *Kindle*, 442.
centronatus *Win.*, *Weller*, 804.

Paleontology—Continued.

Genera and species described—Continued.

Spirifer *crispus* Hisinger 1826, Beecher, 51.
 var. *simplex* Hall 1879, Beecher, 51.
crispus (Hisinger), Grabau, 306.
 var. *corallinensis* Grabau, Grabau, 306.
davisi Nettleroth, Kindle, 442.
divaricatus Hall, Kindle, 442.
duodenarius (Hall), Kindle, 442.
eriensis Grabau, Grabau, 306.
fornacula Hall, Kindle, 442.
granulosus (Con.), Kindle, 442.
gregarius Clapp, Kindle, 442.
 var. *greeni* n. var., Kindle, 442.
grieri Hall, Kindle, 442.
iovensis Owen, Kindle, 442.
lateralis, var. *delicatus*, n. var. (Rowley),
 Greene, 320.
macconathi Nettleroth, Kindle, 442.
macrus Hall, Kindle, 442.
manni Hall, Kindle, 442.
marionensis Shumard, Weller, 804.
niagarensis Conrad, Grabau, 306.
pecularis Shum? Weller, 804.
pennatus (Atwater), Kindle, 442.
radiatus Sowerby 1825, Beecher, 51.
radiatus Sowerby, Grabau, 306.
segmentum Hall, Kindle, 442.
varicosus Hall, Kindle, 452.
varicosa var. *hobbsi* (Nettleroth), Kindle,
 442.
(Delthyris) sulcatus Hall, Grabau, 306.
Spiriferina *horizontalis* n. sp. (Rowley),
 Greene, 320.
solidrostris (White), Weller, 804.
Spirorbis? *dubius* n. sp., Rowley, 658.
Spyroceras *anellus* Conrad sp., Ruedemann,
 660.
Spiroplecta *clarki* Bagg, Bagg, 35.
Stegosaurus *marshi* n. sp., Lucas, 502.
Stellipora *Anthelioidea* Hall, Sardeson, 671.
Steneofiber *complexus* n. sp., Douglass, 234a.
hesperus n. sp., Douglass, 234a.
Stenosteus *glaber* n. gen. et sp., Dean, 227.
Stephanocrinus Conrad, Grabau, 306.
angulatus Conrad, Grabau, 306.
Stictoporella *cribosa* Ulr., Sardeson, 672.
Stomatopora *infata*, Hall, Ruedemann, 660.
Strabops *thatcheri* n. gen. et sp., Beecher, 53.
Straporollus *cyclostomus* (Hall), Kindle, 442.
obtusus (Hall), Weller, 804.
 sp., Kindle, 442.
 sp. undet., Weller, 804.
Streptidura *subscalarina* Heilprin, Clark and
 Martin, 141.
Streptelasma *corniculum* Hall, Ruedemann,
 660.
Streptorhynchus *sub sulcatum* n. sp., Sarde-
 son, 677.
Striatopora Hall, Grabau, 306.
flexuosa Hall, Grabau, 306.
Stromatopora *Goldfuss*, Grabau, 306.
concentrica Goldfuss Hall, Grabau, 306.
Stropheodonta Hall, Grabau, 306.
concava Hall, Kindle, 442.
corrugata Conrad, Grabau, 306.
de missa (Conrad), Kindle, 442.

Paleontology—Continued.

Genera and species described—Continued.

Stropheodonta *hemispherica* Hall, Kindle,
 442.
inequistriata (Conrad), Kindle, 422.
perplana (Conrad), Kindle, 422.
plicata Hall, Kindle, 442.
profunda Hall, Grabau, 306.
 sp., Kindle, 442.
Stropholasia *truncetz* (Hall), Wood, 855.
Strophomena *halli* n. sp., Sardeson, 677.
inquassa n. sp., Sardeson, 677.
Strophonella Hall, Grabau, 306.
 (?) *patenta* Hall, Grabau, 306.
striata Hall 1848, Beecher, 51.
striata Hall, Grabau, 306.
Strophostylus *amplus* n. sp. (Rowley), Greene,
 320.
bivolve (W. & W.), Weller, 804.
variana Hall, Kindle, 442.
Styliola *fissurella* Hall, Kindle, 442.
Synechodus *clarkii* n. sp., Case, 251.
Syringotheris *halli* Win., Weller, 804.
Tænioperis *coriacea* Golp., Sellards, 688.
coriacea var. *linearis* n. var., Sellards,
 688.
newberryana F. and I. C. W., Sellards, 688.
Technophorus *cancellatus* n. sp., Ruedemann,
 659.
Tellina (*Angelus*) *virginiana* Clark, Clark
 and Martin, 141.
 (?) *Peronidia* *papyria* (?) Conrad, Clark
 and Martin, 141.
 (Peronidia?) *williamsi* Clark, Clark and
 Martin, 141.
Tellinomya *candens* n. sp., Sardeson, 677.
 (or *Nucula*) *lepidia* n. sp., Sardeson, 677.
Temnochilus? sp., Greene, 320.
coxanum M. & W. sp. Rowley, Greene,
 320.
Tentaculites *dexithea* Hall, Kindle, 442.
scalariformis Hall, Kindle, 442.
Terebratula *harlani* Morton, Clark and Mar-
 tin, 142.
jucunda Hall, Kindle, 442.
obsolete Hall, Beecher, 51.
Teredo *virginiana* Clark, Clark and Martin,
 141.
Textularia *gramen* d'Orbigny, Bagg, 35.
sagittula Defrance, Bagg, 35.
subangulata d'Orbigny, Bagg, 35.
Thecachampsia sp., Case, 120.
contusor Cope, Case, 120.
marylandica Clark, Case, 120.
sericodon (?) Cope, Case, 120.
Thoracoceras *wilsoni* n. sp., Clarke, 145.
Thysanocrinus Hall, Grabau, 306.
liliiformis Hall, Grabau, 306.
Tornatellæ *bella* Conrad, Clark and Martin,
 141.
Tornoceras Hyatt, Beecher, 51.
Toxochelys *latiremis* Cope, Williston, 837.
Trematopora Hall, Grabau, 306.
 (?) *striata* Hall, Grabau, 306.
tuberculosa Hall, Grabau, 306.
Trematospira Hall, Grabau, 306.
camura Hall, Grabau, 306.

Paleontology—Continued.

Genera and species described—Continued.

- Tretaspis diademata n. sp., Ruedemann, 660.
- reticulatus n. sp., Ruedemann, 660.
- Triacodon fallax Marsh, Wortman, 863.
- Triarthrus becki, Beecher, 51.
- Trigeria ? curriei n. sp., Rowley, 658.
- Trigoniolas osborni n. sp., Lucas, 501.
- Trigonoarea decisca (Conrad) var., Clark and Martin, 141.
- Triisodon heilprianus Cope, Matthew, 538.
- Trionyx virginia Clark, Case, 120.
- Trinucleus, Beecher, 51.
- Tritonium showalteri (Conrad), Clark and Martin, 141.
- Trochoceras Hall, Grabau, 306.
- gebbardi Hall, Grabau, 306.
- Trochoceras clarkeanus Vaughan, Vaughan, 765.
- Trochonema emacerata Hall and Whitf., Kindle, 442.
- rectilatera Hall and Whitfield, Kindle, 442.
- umbilicatum Hall sp., Ruedemann, 660.
- Trophon sublevis Harris, Clark and Martin, 141.
- Tropidoleptus carinatus (Conrad), Kindle, 442.
- Truncatulina lobatula (Walker and Jacob), Bagg, 35.
- ungeriana (d'Orbigny), Bagg, 35.
- Tryblidium exsertum n. sp., Sardeson, 677.
- validum n. sp., Sardeson, 677.
- Tube marylandica n. sp., Clark and Martin, 141.
- Tudicia marylandica n. sp., Clark and Martin, 141.
- sp., Clark and Martin, 141.
- Turbinolia acuticostata Vaughan, Vaughan, 765.
- Turbo shumardi De Verneuil; Kindle, 442.
- Turbonilla potomacensis n. sp., Clark and Martin, 141.
- Turriilepas (?) filosa n. sp., Ruedemann, 659.
- Turritella humerosa Conrad, Clark and Martin, 141.
- mortoni Conrad, Clark and Martin, 141.
- potomacensis n. sp., Clark and Martin, 141.
- Uintacyon Leidy, Wortman, 861.
- edax Leidy, Wortman, 861.
- Unio Retzius, Letson, 493.
- gibbosus Barnes, Letson, 493.
- nanaimoensis n. sp., Whiteaves, 819.
- Urotheca n. gen., Matthew, 529.
- pervetus n. sp., Matthew, 529.
- Vaginulina legumen (Linne), Bagg, 35.
- Valvata Muller, Letson, 493.
- sincera Say, Letson, 493.
- tricarinata Say, Letson, 493.
- Venericardia marylandica n. sp., Clark and Martin, 141.
- planicostata var. regia Conrad, Clark and Martin, 141.
- potapacoensis n. sp., Clark and Martin, 141.
- Vermetus sp., Clark and Martin, 141.
- Vicarya callosa var., Becker, 50.
- semperi n. var., Becker, 50.
- Vitulina pustulosa Hall, Kindle, 442.
- Viverravus Marsh, Matthew, 538.

Paleontology—Continued.

Genera and species described—Continued

- Viverravus Marsh, Wortman, 862.
- gracilis Marsh, Wortman, 862.
- minutus n. sp., Wortman, 862.
- Volutilithes petrosus (Conrad), Clark and Martin, 141.
- sp., Clark and Martin, 141.
- Vulpavus Marsh, Wortman, 891.
- hargeri n. sp., Wortman, 861.
- palustris Marsh, Wortman, 861.
- Westonia n. subgen., Walcott, 771.
- Whitfieldella Hall and Clarke, Grabau, 306.
- cylindrica Hall, Grabau, 306.
- intermedia Hall, Grabau, 306.
- levis (Whitfield), Grabau, 306.
- nitida Hall, Grabau, 306.
- var. oblate Hall, Grabau, 306.
- oblate Hall, Grabau, 306.
- sulcata (Vanuxem), Grabau, 306.
- Whitfieldella nitida Hall 1843, Beecher, 51.
- Whittleseya Newbury 1853, White, 813.
- brevifolia n. sp., White, 813.
- dawsoniana n. sp., White, 813.
- desiderata n. sp., White, 813.
- Worthenia mississippiensis (W. & W.), Welker, 804.
- Xiphias (? radiata Clark), Case, 251.
- Zaphrentis Rafinesque, Grabau, 306.
- albus n. sp., Greene, 319.
- curtus n. sp., Greene, 319.
- infexus n. sp., Greene, 319.
- insolens n. sp., Greene, 319.
- lamasteri n. sp., Greene, 319.
- obscurus n. sp., Greene, 320.
- pusillus n. sp., Greene, 319.
- turbanati (Hall), Grabau, 306.
- Ziphacodon rugatus Marsh, Wortman, 863.
- Zygospira, Beecher, 51.
- aquila n. sp., Sardeson, 677.
- recurvirostris Hall, Ruedemann, 660.
- Panama.**
- Geology of the Isthmus of Panama, Hershey, 365.
- Pennsylvania.**
- Age of the coals at Tipton, White, 810.
- Alleged Parker channel, Williams, 825.
- Anthracite coal near Perkiomen Creek, Carter, 108.
- Buried valley of Wyoming, Griffith, 328.
- Caves of Huntingdon County, Morganroth, 557.
- Graphite and garnet, Hopkins, 389.
- Limestones in the vicinity of Philadelphia, Carter, 115.
- New species of Olenellus, Wanner, 776.
- Occurrence of serpentine and talc, Peck, 590.
- Oil and gas in the vicinity of Philadelphia, Carter, 109.
- On spangolite, Penfield, 596.
- Troost's survey of Philadelphia, Hamilton, 336.
- Water supply for Philadelphia, Carter, 106.
- Petrology.**
- California.**
- Berkeley Hills, Lawson and Palache, 484a.
- California feldspar-corundum rocks from Plumas County, Lawson, 482.

Petrology—Continued.*Canada.*

- Amygdaloidal trap rock, Dresser, 240.
- Areas of nepheline-syenite, Miller, 550.
- Geology of Rigaud Mountain, Le Roy, 492.
- Hor. blende lamprophyre dike at Richmond, Dresser, 239.
- Iron ranges of the Lower Huronian, Coleman, 155.
- Petrography of Mount Orford, Dresser, 241.
- Petrography of Shefford Mountain, Dresser, 242.
- Report of section of chemistry and mineralogy, Hoffmann, 380.

Colorado.

- La Plata folio, Cross, 176.
- Occurrence of limburgite, Stevens, 728.
- Spanish peaks folio, Hills, 374.

Connecticut.

- Newark system of the Pomperaug Valley, Hobbs, 376.

District of Columbia.

- Washington folio, Darton and Keith, 200

Georgia.

- Granitic rocks of Georgia, Watson, 787.
- Origin of the phenocrysts in porphyritic granites, Watson, 789.
- Trap dikes of Georgia, McCallie, 513.

- Weathering of granitic rocks, Watson, 791.

Idaho.

- Geology and water resources of Nez Perces County, Part II, Russell, 662.

Iowa.

- Iowa dolomite, Knight, 445.

Maine.

- Andesites of the Aroostook volcanic area, Gregory, 322.
- Geological study of the Fox Islands, Smith, 707.

Maryland.

- Basic rocks of northeastern Maryland, Leonard, 491.

Massachusetts.

- Amygdaloidal melaphyres of the Boston basin, Crosby, 173.
- Medford dike area, Wilson, 838.
- Structural relations of amygdaloidal melaphyre, Burr, 97.

Mexico.

- Ein Profil durch den Ostabfall der Sierra Madre Oriental, Böse, 72.
- Las rhyolitas, Ordoñez, 573.

Minnesota.

- Keeweenawan area of eastern Minnesota, Hall, 332.
- Keewatin area of eastern and central Minnesota, Hall, 333.

Montana.

- Missourite, a new leucite rock, Weed and Pirsson, 799.
- Petrography of Square Butte, Pirsson, 616.
- Petrography of Yogo peak, Pirsson, 517.
- Shonkin Sag and Palisade Butte laccoliths in the Highwood Mountains, Weed and Pirsson, 798.

New Hampshire.

- Albany granite and its contact phenomena, Hawes, 349.

Petrology—Continued.*New Hampshire—Continued.*

- Composition of labradorite rocks, Dana, 192.
- Eruptive rocks in Campton, Hawes, 348.
- Rocks of Lake Winnepeaukee, Washington, 785.

New Jersey.

- Serpentines of Manhattan Island, Newland, 565.

New York.

- Adirondack augite-andesite, Cushing, 184.
- Geology of Rand Hill, Cushing, 185.
- Serpentines of Manhattan Island, Newland, 565.

Oregon.

- Coos Bay folio, Diller, 231.

Pennsylvania.

- Occurrence of serpentine and talc, Peck, 590.

Vermont.

- Granite of Barre, Finley, 272.

Washington.

- Cleland iron ores, Smith and Willis, 709.
- Geology and water resources of Yakima County, Smith, 708.

Wyoming.

- Spherulites of the Yellowstone and Great Britain, Parkinson, 586.

General.

- Chemical study of the glaucophane schists, Washington, 786.

- Foyaite-ijolite series of Magnet Cove, Washington, 788.

- Foyaite-ijolite series of Magnet Cove, II, Washington, 784.

- Metasomatic processes in fissure veins, Lindgren, 495.

- Nitrates in cave earths, Nichols, 566.

- Origin and classification of gneisses, Gordon, 296.

- Outline of elementary lithology, Barton, 44.

- Perknite (lime-magnesia rocks), Turner, 745.

- Variations of texture in Tertiary igneous rocks of the Great Basin, Spurr, 724.

Rock described.

- Alaskite, Spurr, 724.

- Andesite, Gregory, 322.

- Andesite, Lawson and Palache, 484a.

- Andesite, Smith, 708.

- Anorthosite gabbro, Cushing, 185.

- Arkite (leucite-porphyry), Washington, 788.

- Augite-andesite, Cushing, 184.

- Augite-syenite, Cross, 176.

- Augite-syenite, Cushing, 185.

- Basalt, Diller, 231.

- Basalt, Lawson and Palache, 484a.

- Basalt, Smith, 708.

- Biotite-granite, Spurr, 724.

- Biotite-rhyolite, Spurr, 724.

- Camptonite, Dresser, 239.

- Covite (shonkinite), Washington, 788.

- Diabase, Dresser, 241.

- Diabase, Leonard, 491.

- Diabase, Wilson, 838.

- Diorite, Cross, 176.

- Diorite, Darton and Keith, 200.

- Diorite, Leonard, 491.

- Diorite-gneiss, Darton and Keith, 200.

Petrology—Continued.

Rocks described—Continued.

Diorite-porphyry, Cross, 176.
 Dolomite, Newland, 565.
 Essexite, Dresser, 242.
 Felsite, Wilson, 838.
 Foyaite, Washington, 788.
 Gabbro-diorite, Dresser, 241.
 Gabbro-diorite, Leonard, 491.
 Gneiss, Gordon, 296.
 Granite, Darton and Keith, 200.
 Granite, Finley, 272.
 Granite, Hawes, 349.
 Granite, Peck, 590.
 Granite, Watson, 787, 789, 791.
 Granite, Wilson, 838.
 Granite-gneiss, Darton and Keith, 200.
 Granite-porphyry, Spurr, 724.
 Hornblende-andesite, Spurr, 724.
 Hornblende-biotite-quartz-diorite, Spurr, 724.
 Hornblende-syenite, Le Roy, 492.
 Hornblendite, Spurr, 724.
 Hydromagnesite, Newland, 565.
 Hypersthene-gabbro, Leonard, 491.
 Ijolite, Washington, 788.
 Jacupirangite, Washington, 788.
 Limburgite, Stevens, 728.
 Limonite, Newland, 565.
 Magnesite, Newland, 565.
 Melaphyre, Burr, 97.
 Monzonite, Cross, 176.
 Monzonite, Pirsson, 617.
 Nepheline-syenite, Miller, 550.
 Nordmarkite, Dresser, 242.
 Norite, Leonard, 491.
 Ophicalcite, Dresser, 241.
 Peridotite, Leonard, 491.
 Perkinte, Turner, 745.
 Pulaskite, Dresser, 242.
 Pulaskite, Washington, 788.
 Pyroxenite, Leonard, 491.
 Quartz-porphyry, Le Roy, 492.
 Rhyolite, Ordóñez, 573.
 Rhyolite, Spurr, 724.
 Serpentine, Dresser, 241.
 Serpentine, Leonard, 491.
 Serpentine, Newland, 565.
 Serpentine, Peck, 590.
 Shonkinite, Pirsson, 616, 617.
 Shonkinite, Weed and Pirsson, 798.
 Spherulite, Parkinson, 586.
 Syenite, Peck, 590.
 Syenite, Pirsson, 617.
 Syenite, Weed and Pirsson, 798.
 Syenite-porphyry, Cross, 176.
 Thaumasite, Penfield and Pratt, 602.
 Tremolite, Peck, 590.

Physiographic geology.*Alaska.*

Physiography of the Copper River basin, Spencer, 717.

Appalachian region.

Base leveling and its faunal significance, Adams, 2.
 Charleston folio, Campbell, 105.
 Current notes on physiography, Davis, 208, 211, 214.

Physiographic geology—Continued.

Appalachian region—Continued.

Geology of the Tallulah gorge, Jones, 406.
 Maynardville folio, Keith, 411.
 Paleozoic Appalachia, Willis, 831

Atlantic coast region.

Current notes on physiography, Davis, 217.
 Washington folio, Darton and Keith, 200.

Canada.

Ancient channels of Ottawa River, Ells, 260.
 Current notes on physiography, Davis, 209, 221, 222.
 Exploration of northern side of Hudson Strait, Bell, 57.
 Exploration of south shore of Hudson Strait, Low, 499.
 Geography of Red River Valley, Dowling, 237.
 Geology of the Three Rivers map sheet, Ells, 256.
 Geology of west shore of Lake Winnipeg, Dowling, 236.
 Geology of Yellow Head Pass route, McEvoy, 516.
 Iron ores of Nipissing district, Miller, 551.
 Lake basins in Alberta and British Columbia, Parkinson, 587.
 Physical geology of central Ontario, Wilson, 839.

Physiography of Acadia, Daly, 190.
 Report on parts of Manitoba and Keewatin, Tyrell, 747.

Great Basin region.

Grand Canyon of the Colorado, Davis, 202.

Great Lakes region.

Ancient drainage at Niagara Falls, Currie, 183.
 Current notes on physiography, Davis, 211.
 Geology and paleontology of Niagara Falls, Grabau, 306.
 Ontario coast, Martin, 526.
 Physical history of Niagara River, Gilbert, 293.
 Physiography of Wisconsin, Collie, 158.
 Wisconsin shore of Lake Superior, Collie, 157.

Great Plains region.

Current notes on physiography, Davis, 221.
 Flint hills of Kansas, Mead, 540.
 High plains and their utilization, Johnson, 404.
 Report of Geological Survey, Babcock, 34.

Mexico.

Geographic and geologic features of Mexico, Hall, 373.

Mississippi Valley region.

Geology of Clay and O'Brien counties, Macbride, 510.
 Geology of Louisa County, Iowa, Udden, 748.
 Geology of Marion County, Miller, 548.
 Geology of Page County, Iowa, Calvin, 100.
 Geology of Pottawattamie County, Iowa, Udden, 749.
 Lakes of Indiana and their marl deposits, Blatchley and Ashley, 69.
 Preglacial drainage in southwestern Ohio, Tight, 740.
 When was the Mississippi River Valley formed?, Farnsworth, 266.

New England and New York.

Connecticut rivers, Hobbs, 379.

Physiographic geology—Continued.*New England and New York*—Continued.

Current notes on physiography, Davis, 213, 222.
 Geological history of Charles River, Clapp, 139.
 Newark system of the Pomperaug Valley, Hobbs, 376.
 Physiography of Lake George, Kemp, 417 and 420.
 Reconnaissance of the Elizabeth islands, Hollick, 385.
 River system of Connecticut, Hobbs, 377.

Pacific coast region.

Coos Bay folio, Diller, 231.
 Current notes on physiography, Davis, 206.
 Erosion on the Pacific coast, Holder, 384.
 Geology of the John Day Basin, Merriam, 542.
 Petroleum in California, Claypole, 149.

Rocky Mountain region.

Current notes on physiography, Davis, 210, 213.
 Description of Bates Hole, Wyoming, Knight, 446.

Geology and water resources of Nez Perce County, Part I, Russell, 661.
 Geology of Black Hills, Darton, 198.
 La Plata folio, Cross, 176.
 Spanish peaks folio, Hills, 374.

Southwestern region.

Coalgate folio, Taff, 736.
 Genesis of the Arkansas Valley, Keyes, 425.
 Peneplains of the Ozark Highland, Hershey, 361.
 Physiography of the Boston Mountains, Purdue, 635.

West Indies.

Porto Rico, its topography and aspects, Wilson, 840.

General.

Current notes on physiography, Davis, 205, 207, 212, 213, 215, 219.
 Relation between base leveling and plant distribution, Cowles, 166.
 Relation of physical geography to other science subjects, Norton, 569.

Pleistocene.*Appalachian region.*

Charleston folio, Campbell, 105.

Atlantic coast region.

Pleistocene problem of the North Atlantic coastal plain, Shattuck, 693.

Washington folio, Darton and Keith, 200.

Canada.

Geology of the principal cities in eastern Canada, Ami, 14.

Geology of the Three Rivers map sheet, Ells, 256.

Geology of west shore of Lake Winnipeg, Dowling, 236.

Iron ranges of the Lower Huronian, Coleman, 155.

Physical geology of central Ontario, Wilson, 839.

Sea beaches of eastern Ontario, Coleman, 156.

Shore lines and landslips of St. Lawrence Valley, Chalmers, 122.

Synopsis of geology of Canada, Ami, 15.

Great Basin region.

Borings in Silver Spring Valley, Arizona, Douglas, 235.

Pleistocene—Continued.*Mississippi Valley region.*

Geology of Cedar County, Iowa, Norton, 568.
 Geology of Clay and O'Brien counties, McBride, 510.
 Geology of Louisa County, Iowa, Udden, 748.
 Geology of Marion County, Miller, 548.
 Geology of Page County, Iowa, Calvin, 100.
 Geology of Pottawattamie County, Iowa, Udden, 749.

New England and New York.

Geology of Rand Hill, Cushing, 185.
 Pleistocene geology of Nassau County, Woodworth, 858.
 Reconnaissance of the Elizabeth Islands, Hollick, 385.
 Representatives of pre-Wisconsin till, Fuller, 288.

Pacific coast region.

Coos Bay folio, Diller, 231.
 Geology of the John Day basin, Merriam, 542.

Rocky Mountain region.

Geology of Black Hills, Darton, 198.
 La Plata folio, Cross, 176.

Southwestern region.

Coalgate folio, Taff, 736.
 Oil and gas fields of western interior and Gulf coast, Adams, 7.

West Indies.

Geological and physical development of Antigua, Spencer, 719.

Philippines Islands.

Coal measures of the Philippines, Burritt, 98.
 Geology of the Philippine Islands, Becker, 50.

Silurian.*Appalachian region.*

Maynardville folio, Keith, 411.
 Paleozoic formations of Alleghany County, Prosser, 631.
 Paleozoic limestones of Kittatinny Valley, Kummel and Weller, 457.
 Preliminary report on the Paleozoic formations, Weller, 805.

Canada.

Exploration of northern side of Hudson Strait, Bell, 57.

Geological record of Rocky Mountain region, Dawson, 224.

Geology of the principal cities in eastern Canada, Ami, 14.

Geology of the Three Rivers map sheet, Ells, 256.

Geology of west shore of Lake Winnipeg, Dowling, 236.

Silurian and Devonian formations of eastern Canada, Ami, 25.

Stratigraphical note, Ami, 22.

Synopsis of geology of Canada, Ami, 15.

Great Basin region.

Geology and vein phenomena of Arizona, Comstock, 161.

Mississippi Valley region.

Geology of Cedar County, Iowa, Norton, 568.
 Lower Silurian formations of Wisconsin and Minnesota, Sardeson, 676.

Ordovician rocks of southern Indiana, Cummings, 181.

Upper Ordovician at Vevay, Cummings, 180.

Silurian—Continued.*New England and New York.*

- Faunas of the Ordovician at Glen Falls, White, 818.
- Geological study of the Fox Islands, Smith, 707.
- Geology and paleontology of Niagara Falls, Grabau, 306.
- Hudson River beds near Albany, Ruedemann, 659.
- Reef structures in the Clinton and Niagara strata, Sarle, 678.
- Trenton conglomerate of Rhysedorph hill, Ruedemann, 660.

Ohio Valley region.

- Niagara group, Foerste, 279.
- Silurian and Devonian limestone, Foerste, 278.

Southwestern region.

- Silurian fauna near Batesville, Ark., Van Ingen, 762, 763.

General.

- Siluro-Devonian boundary question, Williams, 827.

South Carolina.

- Carolina gold deposits, Weed, 796.

South Dakota.

- A new dinosaur, Stegosaurus marshi, Lucas, 502.
- A new rhinoceros, Trigonias osborni, Lucas, 501.
- Artesian wells in North and South Dakota, Upham, 752.
- Dakota Cretaceous of Kansas and Nebraska, Gould, 301.
- Geology of artesian basins, McCaslin, 514.
- Gold ores of the Black Hills, Chance, 131.
- Laccoliths of the Black Hills, Jaggar, 402.
- Oligocene beds of the Bad Lands, Fraas, 285.
- Problems of the Dakota artesian system, Todd, 742.

- Stratigraphy of the Black Hills, Darton, 199.

Tennessee.

- Classification of geologic formations of Tennessee, Safford, 665.
- Copper deposits of Southern United States, Weed, 795.
- Horizons of phosphate rocks, Safford, 666.
- Maynardville folio, Keith, 411.
- Silurian and Devonian limestone, Foerste, 278.
- Tennessee white phosphate, Eckel, 254a.
- Tennessee white phosphate, Hayes, 357.

Tertiary.*Atlantic coast region.*

- Administrative report, New Jersey Geological Survey, Smock, 712.
- Eocene deposits of Maryland, Clark and Martin, 140.

- Washington folio, Darton and Keith, 200.

Canada.

- Geological record of Rocky Mountain region, Dawson, 224.
- Geology of Yellow Head Pass route, McEvoy, 516.
- Synopsis of geology of Canada, Ami, 15.

Great Plains region.

- High plains and their utilization, Johnson, 404.
- Note on the western Tertiary, Sardeson, 673.
- Oligocene beds of the Bad Lands, Fraas, 285.

Tertiary—Continued.*New England.*

- Geological history of Charles River, Massachusetts, Clapp, 139.

Pacific coast region.

- Berkeley Hills, Lawson and Palache, 484a.
- Clealum iron ores, Smith and Willis, 709.
- Coos Bay folio, Diller, 231.
- Geological section through John Day Basin, Merriam, 543.
- Geology and water resources of Yakima County, Smith, 708.
- Geology of Salinas Valley, Nutter, 570.
- Geology of the John Day Basin, Merriam, 542.
- Sierra Madre near Pasadena, Claypole, 150.

Panama.

- Geology of the Isthmus of Panama, Hershey, 365.

Philippine Islands.

- Geology of the Philippine Islands, Becker, 50.

Rocky Mountain region.

- Fossil mammalia of White River beds, Douglass, 234a.
- Geology and water resources of Nez Perces County, Part I, Russell, 661.
- Geology of Black Hills, Darton, 198.
- La Plata folio, Cross, 176.
- Note sur les phénomènes volcaniques Tertiaires de la chaîne d'Absaroka, Hague, 330.
- Spanish peaks folio, Hills, 374.

Southwestern region.

- Calgoalte folio, Taff, 736.
- Oil and gas fields of western interior and Gulf coast, Adams, 7.
- Oil in Texas, Harris, 340.
- Pelvic girdle of Zeuglodon *Basilosaurus cetoides* (Owen), Lucas, 502.
- Texas petroleum, Phillips, 608.

West Indies.

- Geological and physical development of Antigua, Spencer, 719.
- Geological and physical development of Anguilla, St. Martin, St. Bartholomew, and Sombrero, Spencer, 721.
- Geological and physical development of Guadeloupe, Spencer, 720.
- Geological and physical development of the St. Christopher chain and Saba banks, Spencer, 722.

Texas.

- Bat guano caves in Texas, Phillips, 611.
- Beaumont oil field, Phillips, 609.
- Coast prairie of Texas, Hall, 372.
- El Paso tin deposits, Weed, 797.
- Geology of Beaumont oil fields, Dumble, 248.
- Iron ores of east Texas, Dumble, 247.
- Kansas-Oklahoma-Texas gypsum hills, Gould, 300.
- Mart and Bluff meteorites, Charlton, 134.
- Meteorite from Allegan, Michigan, and Mart, Texas, Merrill and Stokes, 546.
- Minerals and mineral localities of Texas, Simonds, 702.
- Oil and gas fields of western interior and Gulf coast, Adams, 7.
- Oil in Texas, Harris, 340.
- Quicksilver mines of Brewster County, Spalding, 715.

Texas—Continued.

Texas oil well fossil, Alderson, 10.
Texas petroleum, Phillips, 60a.

Trinidad.*Canada.*

Geological record of Rocky Mountain region, Dawson, 224.
Synopsis of geology of Canada, Ami, 15.

New England.

Newark system of the Pomperaug valley, Hobbs, 376.

Pacific coast region.

Border line between the Paleozoic and Mesozoic, Smith, 710.

Rocky Mountain region.

Border line between the Paleozoic and Mesozoic, Smith, 710.

Dinosaur beds of the Grand River Valley, Riggs, 650.

Geology of Black Hills, Darton, 198.

La Plata folio, Cross, 176.

Trias in northeastern Oregon, Lindgren, 497.

Triassic and Jurassic strata of the Black Hills, Hovey, 395.

Southwestern region.

Fossils from the Red Beds, Gould, 297.

Kansas-Oklahoma-Texas gypsum hills, Gould, 300.

Utah.

Fault slip in Ogden Canyon, Talmage, 737.
Notes on two desert mines, Emmons, 262.

Vermont.

Asbestos region in northern Vermont, Kemp, 416 and 419.

Geology of Vermont, Seeley, 687.

Granite of Barre, Finley, 272.

Occurrence of asbestos, Kemp, 420a.

Sketch of the life and work of Augustus Wing, Seeley, 486.

Virginia.

Analysis of emery, Miller, 553.

Copper deposits of Southern United States, Weed, 795.

Sandstone from Augusta County, Miller, 554.

Washington folio, Darton and Keith, 200.

Washington.

Clealum iron ores, Smith and Willis, 709.

Discussion of Clealum iron ores, Courtis, 165.

Geology and water resources of Yakima County, Smith, 708.

Ores of the Republic mine, Chatard and Whitehead, 135.

Silverton mining district, Stretch, 734.

West Indies.

Bituminous deposits of Cardenas, Cuba, Peckham, 591.

West Indies—Continued.

Copper mines of Santa Clara Province, Cuba, Vaughan, 769.

Fossil corals from the elevated reefs of Curacao, Aruba, and Bonaire, Vaughan, 766.
Geological and physical development of Antigua, Spencer, 719.

Geological and physical development of Aguilla, St. Martin, St. Bartholomew, and Sombbrero, Spencer, 721.

Geological and physical development of Guadeloupe, Spencer, 720.
Geological and physical development of the St. Christopher chain and Saba banks, Spencer, 722.

Gigantic fossil Lucina, Dall, 188.

Iron ores of Cuba, Spencer, 716.

Manganese mining in Cuba, Chibas, 137.

Porto Rico, its topography and aspects, Wilson, 840.
Stony corals of the Porto Rican waters, Vaughan, 766a.

West Virginia.

Charleston folio, Campbell, 105.

Geological map of West Virginia, White, 815.

Geology of West Virginia, White, 816.

Wisconsin.

Clays and clay industries, Buckley, 94.

Copper-bearing rocks of Douglas County, Grant, 313.

Iron ore deposits of the Lake Superior region, Van Hise, 759.

Junction of Lake Superior sandstone and Keeweenawan traps, Grant, 314.

Lower Silurian formations of Wisconsin and Minnesota, Sardeson, 676.

Physiography of Wisconsin, Collie, 158.

Wisconsin shore of Lake Superior, Collie, 157.

Wyoming.

Alkali lakes and deposits, Knight and Slosson, 451.

Description of Bates Hole, Knight, 446.

Dutton, Rattlesnake, Arago, Oil Mountain, and Powder River oil fields, Knight and Slosson, 450.

Geology of Black Hills, Darton, 198.

Geology of the oil fields, Knight, 449.

Iron mines of Hartville, Chance, 132.

Jurassic stratigraphy in Wyoming, Loomis, 498.

Note sur les phénomènes volcaniques Tertiaires de la chaîne d'Absaroka, Hague, 330.

Petroleum fields, Knight, 447.

Stratigraphy of the Black Hills, Darton, 199.

Sweetwater mining district, Knight, 448.



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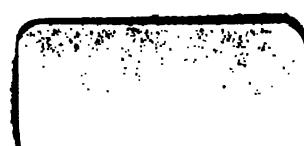
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